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INDEX TO VOLUME XI.

LIST OF ILLUSTRATIONS.

ERRATA.

Page 57, col. 1, 21st line from bottom, for 'thallophytes' read 'protophytes.'
" 67, " 1, 35th line from top, for 'Herndon' read 'Heudon,' as also throughout the paragraph.
" 69, " 2, 27th line from bottom, for '\$2' read '\$1.'
Page 96, col. 1, last line, for '108' read '118.'
" 119, " 1, 5th line from bottom, for 'homogeneous' read 'homonymous,' for 'image' read 'images,' and for 'it' read 'they.'

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SCIENCE

AN ILLUSTRATED JOURNAL PUBLISHED WEEKLY.

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FRIDAY, JANUARY 6, 1888.

THE CENTURY MAGAZINE has done an excellent thing in printing two diverse views of manual training side by side in its January issue. The expression of the two views is typical of the discussions now so prominent on this subject, and illustrates excellently why the movement in favor of manual training is so strong, and why the opposition to it is so weak. Superintendent MacAlister of Philadelphia states succinctly just what is being done in that city in the line of manual training. This summary is clear and comprehensive; his own approval of it, based on experience, is unqualified; and he tells us that manual training has won the confidence of the community. Superintendent Dutton of New Haven follows with a brief statement of the work in his city, and states that "the effect of these several forms of industrial effort upon teaching generally is good." Both of these gentlemen deal with facts with which they are perfectly familiar, and their favorable judgment upon manual training, while unqualified, is carefully and thoughtfully expressed. The gentleman who opposes manual training is Superintendent Marble of Worcester, Mass. His argument, if such it can be called, is an hysterical juggling, with more or less crude theories, and not a single fact is cited throughout his paper. An approach to a fact is the statement that a phase of manual training was tried fifty years ago, and proved a dead failure. This, however, is not true; nor, if it were, would it prove what Mr. Marble thinks it does. Manual training, as now comprehended and expounded, is not more than a dozen years old at most, and the most cursory knowledge of educational history should have acquainted Mr. Marble with this fact. The same writer talks about "the protestations of those self-constituted philanthropists," "the overthrow or subversion of the public school," "that virile quality of thought and mental power which it is the province of education to beget," "the materialistic tendency of manual training," and so on, and succeeds in demonstrating only that he is in absolute ignorance of what manual training is, and of what it is intended to accomplish. When we read a paper such as this, coming from a professed educator, it is the more easy to understand and to condone the crude speculations and outrageous theories concerning education that so often emanate from persons in no way connected with the school system of the country.

FERDINAND VANDEVEER HAYDEN.

PROF. FERDINAND VANDEVEER HAYDEN, M.D., Ph.D., LL.D., who died in Philadelphia on the morning of Dec. 22, was born in Westfield, Mass., Sept. 7, 1829. Early in life he went to Ohio. In 1850 he was graduated from Oberlin College, and soon afterward read medicine at Albany, N.Y., receiving his degree from the Albany Medical College in 1853. He did not begin the practice of medicine, but in the spring of the year of his graduation was sent by Prof. James Hall of Albany, with Mr. F. B. Meek, to visit the Bad Lands of White River, to make collections of the cretaceous and tertiary fossils of that region. This was the beginning of his explorations of the West, which continued with little interruption for more than thirty years.

In the spring of 1854, Dr. Hayden returned to the Upper Missouri region, and spent two years in exploring it, mainly at his own expense, although he was aided a portion of the time by gentlemen connected with the American Fur Company. During these two years he traversed the Missouri River to Fort Benton, and the Yellowstone to the mouth of the Big Horn River, and explored considerable portions of the Bad Lands of White River and other districts not immediately bordering upon the Missouri. The large collections of fossils he made, were given partly to the Academy of Sciences in St. Louis, and partly to the Academy of Natural Sciences of Philadelphia.

As one of the members of the Geological Survey has recently said, these collections furnished the data for profitable scientific investigation; and the researches then begun mark the commencement of the epoch of true geologic investigation of our Great West. These collections attracted the attention of the officers of the Smithsonian Institution; and in February, 1856, Dr. Hayden was employed by Lieut. G. K. Warren, of the United States Topographical Engineers, to make a report upon the region he had explored; so that the results of his labors during the three previous years were utilized by the government. This report was made in March of the same year, and in May following he was appointed geologist on the staff of Lieutenant Warren, who was then engaged in making a reconnaissance of the North-west. He continued in this position until 1859, when he was appointed naturalist and surgeon to the expedition for the exploration of the Yellowstone and Missouri Rivers, by Capt. William F. Raynolds of the Corps of Engineers of the United States Army, with whom he remained until 1862. The results of his work while with Lieutenant Warren were published in a preliminary report of the War Department, and in several articles in the 'Proceedings of the Academy of Natural Sciences of Philadelphia for the Years 1857 and 1858,' and more fully in a memoir on the geology and natural history of the Upper Missouri, published in the 'Transactions of the American Philosophical Society,' Philadelphia, 1862. This paper also included chapters on the mammals, birds, reptiles, fishes, and recent mollusca of the region in which his geological investigations were carried on. During this time also he found time to make notes upon the languages and customs of the Indian tribes with which he came in contact. These notes were embodied in 'Contributions to the Ethnography and Philology of the Indian Tribes of the Missouri River,' published in the 'Transactions of the American Philosophical Society,' Philadelphia, 1862; in a 'Sketch of the Mandan Indians, with some Observations illustrating the Grammatical Structure of their Language,' published in the *American Journal of Science* in 1862; and in 'Brief Notes on the Pawnee, Winnebago, and Omaha Languages,' published in the 'Proceedings of the American Philosophical Society,' Philadelphia, 1869.

In May, 1862, Dr. Hayden was appointed acting-assistant surgeon of volunteers by the surgeon-general of the United States Army, and was sent to Satterlee Hospital in Philadelphia. He was confirmed by the United States Senate as assistant-surgeon and full surgeon of volunteers on the same day (Feb. 19, 1863), and sent to Beaufort, S.C., as chief medical officer, where he remained for one year, when he was ordered to Washington as assistant medical inspector of the Department of Washington. On the 19th of February, 1864, he was sent to Winchester, Va., as chief medical officer of the army in the Shenandoah valley. Here he remained until May, 1865, when he resigned, and was brevetted lieutenant-colonel for meritorious services during the war. During the remainder of the year 1865 he was employed in work at the Smithsonian Institution. It was during this year that he was elected professor of geology and mineralogy in the University of Pennsylvania, — a position he held until 1872, when the increased executive duties in connection with the Geological Survey of the Territories induced him to resign.

In the summer of 1866 he undertook another expedition to the Bad Lands of Dakota, under the auspices of the Academy of Natural Sciences of Philadelphia, for the purpose of clearing up some doubtful points in the geology of that region, and returned with large and valuable collections of vertebrate fossils, which were described in a memoir published by the Academy of Natural Sciences of Philadelphia in 1869. From 1867 to 1879 the history of Dr. Hayden is the history of the United States Geological Survey of the Territories, of which he was geologist-in-charge, and to the success of which he devoted all his energies during the twelve years of its existence. In this time more than fifty volumes, together with numerous maps, were issued under his supervision. One of the results of his surveys, and the one in which he probably took the greatest interest, was the setting-aside by Congress of the Yellowstone National Park. The idea of reserving this region as a park or pleasure-ground for the people originated with Dr. Hayden, and the law setting it apart was prepared under his direction. The work of the Geological Survey of the Territories had its consummation in the Atlas of Colorado, which increased greatly our knowledge of one of the most interesting portions of the Great West. In 1879, after the disbanding of the Survey of the Territories, Dr. Hayden received an appointment as geologist on the newly organized United States Geological Survey. For about three years he was occupied in the completing of the business of the Geological and Geographical Survey of the Territories, and the preparation of the final results of that survey. His health had already begun to fail, but early in 1883 he asked to be relieved from the supervision of the printing of the reports, and during the three following seasons he undertook field-work in Montana. By the latter part of the year 1886 his health had become so poor that he was confined most of the time to his bed. He then resigned his position as geologist, closing an honorable connection with the government that included twenty-eight years of actual service as naturalist, surgeon, and geologist. To the general interest in science excited by the enthusiastic labors of Dr. Hayden, in his geologic explorations, is due in a great degree the existence and continuance of the present United States Geological Survey.

In 1876 the degree of LL.D. was conferred upon him by the University of Rochester, and in June, 1886, the same degree was conferred upon him by the University of Pennsylvania. Dr. Hayden was a member of the National Academy of Sciences and of many other societies scattered throughout the country. He was also honorary and corresponding member of a large number of foreign societies.

As to Dr. Hayden's personal character, those who were personally associated with him know best how genial he was, and how sincere and enthusiastic his desire to forward the cause of science. Although impulsive at times, he was generous to a fault. His subordinates all knew that each one stood upon his own merits, and that due credit would be awarded his successful efforts. The same spirit actuated him in respect to those not immediately connected with him. His views are expressed as follows in one of his earliest reports, when speaking of those who had preceded him: "Any man who regards the permanency or endurance of his own reputation will not ignore any of these frontier men who made their early explorations under circumstances of great danger and hardship."

His ideas were broad and liberal. He aimed to make a thorough astronomical, topographical, geological, and botanical survey of the Great West, with a view to the development of its mining and agricultural resources. The greater part of his work for the government and for science was a labor of love.

SCARLET-FEVER REPORT.[1] — II.

DR. R. G. Eccles of Brooklyn, N.Y., does not believe that scarlet-fever ever arises except from a pre-existent case, and says, "The following from Dr. H. B. Baker of Lansing, Mich., will help to explain some possible cases of so-called *de novo* origin: 'The Michigan State Board of Health has received information from Dr. Sifton, health-officer of Sutton's Bay Township, which illustrates in a striking way how this country gets contagious diseases from the old countries. Oct. 2, 1887, a family arrived in Sutton's Bay, Leelanaw County, direct from Norway. The family came over in the steamship "Ohio," of the Inman line, reaching New York, Sept. 30. Scarlet-fever was on board the steamer during the passage, one child dying before the landing, and "several more were sick in the same way." One child of this family was taken sick with scarlet-fever the day after reaching New York. The family, however, proceeded over the New York Central and the Lake Shore and Michigan Southern, to Michigan; then over the Detroit, Grand Haven, and Milwaukee, and the Grand Rapids and Indiana, to Traverse City; then to Sutton's Bay. Another child of the family has since come down with the disease. The family had a certificate, signed by the surgeon of the steamer, that they had been protected by vaccination against small-pox: so they passed without detention the quarantine authorities at the port of New York, after they had been exposed to a contagious disease which causes more deaths by far in this country than small-pox causes.'" He gives the following as an instance of the communicability of scarlet-fever which came under his own observation: "Arthur G., aged eight, came from the country to his Brooklyn home in sound health. A case of scarlet-fever (convalescent) being in the house upon his arrival, he was within twenty-four hours removed to other quarters, where there were no children and no disease. In a few days he had a severe attack. By perfect isolation no new cases occurred. Many such instances of short contact giving the disease have come under my observation. The best illustration my experience affords occurred during a visit I made to Wyandotte, Kan., in the winter of 1883. Mrs. S. had been visiting relatives in a distant State. In one family she called upon, they had scarlet-fever. The children were not with her. On her return home in a few days, a daughter, aged seven, was taken sick with what proved to be scarlet-fever. At this time there was not a case but itself in the town, nor had there been for many months. In their trouble, neighbors called, and within two weeks there were ten or more cases. A relative who helped them in the care of the child had three cases in his own family, he proving to be one of the victims. Two customers of his who were waited upon by him while indisposed, but not confined to bed, had each cases among their children after the exposure. No other source of contagion was possible. It must here have been carried in the clothing. Mrs. H. (my wife's mother), living in the country, visited a neighbor some miles distant, where a child was sick with scarlet-fever. A few days after the visit, her own son, aged four, who had not been exposed, was taken sick of this disease and died. There was no possible way of carrying the contagion other than upon the mother's clothes. Boards of health should require all cases to be reported to them by district sanitary inspectors, aided by physicians, the police, and the public. Their duties should be the ferreting-out of every case of contagious disease. To-day the position of inspector is a sinecure. Those holding such positions are well paid for doing almost nothing. Nearly half the cases of contagious diseases that occur, physicians do not see, nor even hear of, until some dangerous complication arises to give alarm. If they pursue a mild course, they are not heard of by the board of health, and the public schools and public conveyances scatter their virus broadcast. Conscientious physicians, too, are put at a disadvantage by their unscrupulous competitors for public favor. The doctor who is known to faithfully report every case loses his practice. People are afraid to call him, because he interferes with the progress of the children at school, and often cuts off their source of livelihood, where they carry on some industry at home. Very many physicians have boasted to me that they never report such cases unless they become so serious that they are likely to lose them. Nor can any law compel them to do so, as it is easy to introduce the claim that they had not made out a positive diagnosis. Let the inspectors, who are independent of the patients' friends, discover and report them, using all possible means as assistance."

In reference to a plan for preventing the spread of the fever, Dr. Eccles says, "The evidence we have, indicates that the germs or spores float as impalpable dust in the air. It is found by experiment that wet gauze, by evaporation, is colder than surrounding

[1] Continued from *Science* of Dec. 16, 1887.

air. Dust is attracted from warm air to a cold body. If that body is wet, it adheres. By canopies of mosquito-netting over the sick-bed, kept wet with bichloride-of-mercury solution containing glycerine, no dust can pass through the meshes in either direction. The cooled threads attract across the narrow space of the mesh all dust that reaches there. The glycerine and water fix it, and the corrosive sublimate sterilizes it. To keep up the application, two layers of netting are required, — one fixed, the other removable. The outer removable one can at stated times be wrung out of a fresh solution, and put back again. Overlapping folds can allow the passage of food, medicine, etc., to the patient. This provides perfect isolation even in a room occupied by others."

R. Harvey Reed, M.D., Mansfield, O., secretary State Sanitary Association, has known cases where old rags taken and sold from scarlet-fever cases have been used by wipers, and they in turn have communicated the disease to their families. He could give many others if it were necessary, but this fact has long since been established.

D. S. Kellogg, M.D., Plattsburgh, N.Y., believes that the disease may arise *de novo*, and bases his belief on the ground that he has had cases which he cannot *reasonably* determine, after careful investigation, originated from any previously existing case. He says, "I believe scarlet-fever to be communicable, yet last spring my belief received a severe blow. My little boy, aged six, was severely sick with this disease. My baby, aged three, slept across the hall; and my son, aged eight, slept down stairs. The sick boy was kept in a room by himself. Yet his mother and I were constantly going from the sick one to the well ones, and *not either* one of them took the disease. The sick boy 'peeled' so thoroughly that the sheets had to be shaken in order to get rid of the fine flakes of skin. He had many toys that he played with after convalescence set in. I disinfected the room in about six weeks from the beginning of his sickness, and the toys. He and the two other children have played with these toys ever since, have slept in the room for a number of months, and have not had any further scarlet-fever." He does not believe that any thing can be done by the use of remedies to prevent well persons from contracting the fever. He believes that if a person has been exposed to scarlet-fever, the better his physical condition, the better is he able to endure the disease. There are many instances that would make this not seem true.

T. D. Crothers, M.D., Hartford, Conn., says, "In 1868 I traced in an epidemic twenty-one cases to contagion clearly. The communicability was by contact in most cases; in others it was through the near association. In two instances a linen picture-book was the medium of communication of the poison. In several cases it was taken by the clothing of persons who had been nursing such cases. Clothing has retained this infection several weeks when confined in a trunk. Many cases have occurred in a community, and been confined to a single case by means of isolation, quarantine, disinfection, and extreme cleanliness."

William H. Brewer, professor in Sheffield Scientific School of Yale University, New Haven, Conn., in reply to the question whether scarlet-fever ever arises *de novo*, says, "There are insufficient data for a *positive belief*. From the evidence, however, that we have, I say *no*, until better evidence is brought forward that it does arise *de novo*. Quarantine the cases if public opinion will justify: if not, then the first duty of the board is to educate the public as to the facts and the dangers. So soon as the public is ready for it, scarlet-fever will be more rare than the small-pox. But before this can be brought about, there must be a strong public feeling that it is a controllable disease."

W. C. Van Bibber, M.D., Baltimore, Md., thinks that boards of health should endeavor to change the non-sanitary condition of neighborhoods and places; for, although scarlet-fever may not now be fairly numbered among the filth-diseases, yet cleaning and sanitary laws may do good on general principles. Cleaning, segregation, and belladonna internally, ventilation, and increased vigor by increasing the vigor of individuals, should be employed. He says, "I attended Christ Church Charity School, Baltimore, for thirty-six years. The means above mentioned were used where a case of scarlet-fever occurred. The school consisted of thirty-two children. In thirty-six years there was but one death. The disease appeared in the school more than twenty times, and was always kept confined to but few children by means of these precautions. By personal hygiene, continued life in open air, the use of belladonna internally to those exposed, and rubbing the diseased body with disinfectants, much may be done to prevent the spread of the disease. I combine in an oil embrocation (thymol, anise-oil) carbolic and salicylic acids, and camphor.

DO FORESTS INFLUENCE RAINFALL?

IT is very generally believed that the culture of forests induces an increase in rainfall, and that their destruction diminishes it. A satisfactory explanation of this supposed phenomenon has never, as far as I am aware, been offered; and the only tangible support for the theory appears to consist in a few observations of rainfall in limited areas in central Europe, made before and after reforesting. It seems desirable that the question should be tested by all the evidence at hand, and the theory established or disproved by the facts. We have in this country the material for testing both phases of the theory upon a large scale and in an exhaustive manner.

The prairie region, including Iowa, northern Missouri, southern Minnesota, most of Illinois, and a small part of Indiana, has, during the past thirty years, undergone a great change with respect to its vegetation. This great area of over 100,000 square miles, was, when settlement commenced, mainly grass-covered. It contained no forests. Belts of trees were found along the water-courses, upon the slopes of river-bluffs, and here and there upon the slight elevations. But man has encouraged the growth of trees, and the area of arborescent vegetation has been greatly increased. It is an example of reforesting upon an immense scale, unequalled elsewhere upon the globe. Has the rainfall correspondingly increased?

The early settlers in Ohio found it mainly a forest-covered region. It has been remorselessly cleared. This area of 40,000 square miles does not contain to-day a tithe of the timber-land that it contained fifty years ago. Has the rainfall diminished?

The States of Massachusetts, Rhode Island, and Connecticut, with adjacent parts of New York, New Hampshire, and Maine, — an area of perhaps 25,000 square miles, — were, when Europeans entered them, densely covered with forests. In time these were almost entirely cleared away. In recent years, however, a change in the occupations of the people of this densely settled region, in virtue of which the farms are being abandoned, while the inhabitants are becoming massed in the cities, has allowed an enormous increase in the wooded area of these States. To-day at least half this area is again covered with woods.

If this theory be correct, the rainfall in this region should have diminished from the colonial times down to, say, 1860, while since that date it should have been on the increase. Are these the facts?

We have here three areas of considerable magnitude, in which radical changes in the forest-covering have been made during the present century. Fortunately, also, we have ample records of the rainfall during these periods.

First, however, a word as to the character of the rainfall. Of all current meteorological phenomena, rainfall is the most irregular, both as to time and place. The rainfall of one year may be double or treble that of the year before or the year following. At any one station these fluctuations are ordinarily so great as to thoroughly mask any secular change. It may vary greatly from place to place, even though the distance be small, while the change of the location of a gauge from the ground to the top of a house may make it give very different indications. For these reasons it is apparent that reliable results, in regard to a general increase or decrease of rainfall, are to be obtained only by combining a large number of observations scattered over many years and over the greatest possible variety of conditions. It is a very easy matter to so select stations, and years of observation, as to obtain any pre-arranged result.

If there has taken place a change in the amount of rainfall in any or all of these regions, it must, in the nature of things, have been a progressive one, however disguised by sporadic fluctuations. Moreover, if this increase or decrease in rainfall produces the results claimed for it, making a desert fruitful, or the reverse, it must be of considerable magnitude, sufficient to be expressed in inches, annually.

In the prairie region I find twenty-four stations at which extended series of rainfall measurements have been made. None which have been used are less than ten years in duration, and they range thence up to forty years. The sum of all these series is four hundred and twenty-eight years. Each of these series was divided into two equal parts, and the total rainfall of each half obtained. On the theory of a progressive increase, the sum of the second half of the series should be greater than that of the first half. The following table exhibits the result. The first column gives the names of the stations; the second, the length of the series; the third, the total rainfall in the first half of each series; the fourth, the same for the second half; and the fifth column, the differences between them, an increase having the plus-sign, a decrease the minus-sign.

Prairie Region.

STATIONS.	YEARS.	AGGREGATE RAINFALL.		DIFFERENCES.
		1st half.	2d half.	
Chicago	22	348	420	+72
Athens	16	332	299	—33
Augusta	18	352	341	—11
Dubois	10	221	186	—35
Galesburg	10	175	158	—17
Manchester	18	335	325	—10
Marengo	16	354	269	—85
Ottawa	14	266	235	—31
Peoria	18	322	296	—26
Riley	14	269	237	—32
Sandwich	12	323	242	—81
Winnebago	14	271	239	—32
Wyanet	10	195	191	—4
Springfield	30	704	763	+59
Dubuque	18	293	317	+24
Omaha	16	235	318	+83
Leavenworth	18	367	363	—4
Davenport	22	463	406	—57
La Crosse	24	418	412	—6
Milwaukee	40	611	657	+46
Brookside	10	232	250	+18
Fort Madison	26	569	457	—112
Iowa City	14	306	282	—24
Muscatine	18	414	369	—45

The results, as will be seen, have a wide range, some stations showing an increase, while much the larger number show a decrease. Now, although these series overlap one another in all sorts of ways, and do not necessarily refer to the same years, still, under the theory of a progressive change, they may be combined directly without involving error. We may add up columns 1 and 2 and strike a balance, and this balance shows a greater rainfall in the first period by 343 inches. Dividing this by the number of years in the period, 217, it is discovered that on an average each station received per year 1.58 inches more rain during the first period than during the second: in other words, instead of an increase of rainfall being produced by the increase of arborescent vegetation, there has occurred, from some cause, an actual diminution. I should be very slow to argue from this a deleterious action flowing from the increase of forests, but it seems to militate very strongly against a favorable action upon rainfall.

In Ohio the contrary result is to be sought; viz., a decrease in rainfall owing to the destruction of forests. In this State I find twelve stations, with series ranging from ten to forty-eight years each, and an aggregate of two hundred and ninety-four years. The observations have been treated as were those in the prairie region, with results as given in the following table:—

Ohio.

STATIONS.	YEARS.	AGGREGATE RAINFALL.		DIFFERENCES.
		1st half.	2d half.	
Cincinnati	46	1044	965	—79
Cleveland	28	513	531	+18
College Hill	14	329	319	—10
Hillsboro'	16	329	307	—22
Hudson	12	203	241	+38
Kelley's Island	10	166	159	—7
Marietta	48	1005	1033	+28
Portsmouth	26	475	547	+72
Steubenville	40	807	836	+29
Toledo	22	412	364	—48
Urbana	18	353	333	—20
Waterville	14	275	245	—30

It will be seen that in this case the total rainfall of the first half of the series is slightly greater than that of the second half, the difference being 31 inches, which, divided by the number of years in the first half of the series, shows, that, along with the clearing of the forests, the rainfall has diminished a trifling amount, being 0.21 of an inch less in each year of the second period than the first. It is, of course, unnecessary to add that this change is too small to have any meaning.

In the third area, that of southern New England, there is to be expected a diminution of the rainfall, consequent upon deforesting, which was in progress down to, say, 1860, and, in more recent times, an increase due to reforesting. Prior to 1860, I have eighteen series, ranging in length from ten to forty-six years, with an aggregate of four hundred years. Treated as before, the results shown in the following table are obtained. Summed up, they show that the aggregate rainfall in the second period was greater by 579 inches, or 2.9 inches in each year of the period. Deforesting, in this case, seems to be accompanied by a decided increase in rainfall.

New England.

STATIONS.	YEARS.	AGGREGATE RAINFALL.		DIFFERENCES.
		1st half.	2d half.	
Amherst	24	506	550	+44
New Haven	20	456	453	—3
Boston	34	689	723	+34
Cambridge	20	435	491	+56
Lowell	12	267	274	+7
Lunenburgh	20	493	544	+51
New Bedford	46	978	958	—20
Waltham	10	231	212	—19
Worcester	20	435	523	+88
Fort Adams	12	294	273	—21
Providence	28	539	613	+74
Flatbush	26	555	555	0
Albany	26	527	528	+1
Jamaica	22	402	413	+11
New York	10	211	246	+35
West Point	20	466	486	+20
Brunswick	30	604	748	+144
Gardiner	20	379	456	+77

Subsequent to 1860, I have fourteen series, ranging in length from ten to twenty-four years, with an aggregate of two hundred years. The results, presented below, show that the rainfall in the two halves of these series was identical.

Stations.	Years.	Aggregate Rainfall.		Differences.
		1st half.	2d half.	
Amherst	14	318	310	—8
New Haven	14	347	348	+1
Boston	24	597	572	—25
Fort Trumbull	10	241	229	—12
Middletown	14	324	338	+14
Lawrence	12	279	265	—14
Lunenburgh	14	313	343	+30
New Bedford	14	300	348	+48
Providence	16	377	393	+16
Albany	16	328	305	—23
Flatbush	12	234	237	+3
New York	16	373	382	+9
West Point	10	246	209	—37
Gardiner	14	305	303	—2

With these results in view, it seems idle to discuss further the influence of forests upon rainfall from the economic point of view, as it is evidently too slight to be of the least practical importance. Man has not yet invented a method of controlling rainfall.

HENRY GANNETT

THE GERM THEORY AS A SUBJECT OF EDUCATION.

THE time is past when it is necessary to discuss the probability of the 'germ theory' as explaining infectious diseases. This is no longer a theory, but as fully demonstrated as most of the other universally accepted conclusions of science. No one to-day who is competent to form a judgment from a knowledge of the facts, will doubt that many infectious diseases are caused by the growth of microscopic organisms in the body. Of course, no general proof of the parasitic nature of all infectious diseases has been adduced, nor is such general proof possible; but when the causal connection between certain specific bacteria and definite infectious diseases has in many cases been proved by a demonstration so conclusive as to be beyond question, and when such causal connection has been rendered extremely probable in many other cases, indeed in almost every infectious disease, it is only ignorance of the facts that can explain any doubt as to the very general applicability of the theory. It is true that many, perhaps a majority, of practising physicians do not have much sympathy with the conception of the parasitic nature of infection, sometimes indeed treating the whole subject with ridicule. Some are incapable of forming correct judgments, but most of them have not found the time or inclination to study the subject enough to know what facts have been established. At the time when most of the physicians who are now practising were pursuing their studies, the germ theory of disease was scarcely entertained as a theory, and nowhere accepted. Only three or four years ago some of our better medical schools taught their students that the theory was a wild hypothesis, and destined to be exploded like any other visionary speculation. It is not surprising, therefore, that they should still refuse to accept a theory which so revolutionizes the conceptions of disease. But our leading physicians, including professors in better medical schools, are now convinced of the truth of the theory and the great importance of the subject, and medical papers throughout the country are giving more and more space to the subject of bacteriology. The inevitable result of this will be that the next generation of doctors will accept the germ theory as the basis of practice.

This discovery of the parasitic nature of infectious diseases is of more than scientific interest: it is of vast practical value. It has not yet, perhaps, contributed very materially to the methods of treating disease directly, although we may confidently expect great results in the future along this line. There is nothing to prevent direct experiments with germicides upon living bacteria in the laboratory, and we may hope in this way to get a more scientific method of curing infectious diseases, after the theory of their parasitic nature becomes more truly the property of doctors as well as of scientists. Thus far, however, the value of the theory has been rather as the foundation of the science of preventive medicine. Here its importance cannot be overrated, and is only beginning to become realized.

We need do no more than mention the advances made in surgery in the last twenty years, which are due almost solely to the knowledge of septic bacteria. It needs no words to enforce the value of discoveries in this line. Every one appreciates this matter; and the value of antiseptic dressing, which alone makes the difficult operations possible, is almost everywhere recognized, and its use taught in all medical schools.

In other lines than surgery the value of the germ theory is even greater, though at first sight not quite so apparent, since the matter is yet in its infancy. The great advantage which we are to acquire through this theory is not in curing infectious diseases, but in preventing them. Professor Koch, in a recent address to a class of medical students, voiced this fact: "Gentlemen," he said, "you have been hitherto taught only how to cure disease, in the future you will be taught how to prevent disease." We can see in this direction great practical results arising along at least two different lines. The first is by preparing the body to resist the disease, the method of inoculation. The most widespread instance of this method of treatment is of course vaccination for small-pox. Vaccination was discovered, it is true, empirically, and entirely independent of the germ theory; but it finally received its *rationale* through the brilliant work and generalizations of Pasteur. Working in accordance with the same idea of preventing a severe form of a disease by giving the individual previously a mild form, Pasteur has successfully treated splenic-fever and hydrophobia. Others, following in his lead, claim success in a similar treatment of yellow-fever and cholera, although these claims certainly need further verification. But only a beginning has been made in this direction, and it does not seem improbable that we may see a time when many of our most severe epidemics may be as thoroughly subdued by inoculation as small-pox has been by vaccination.

But of much more importance than inoculation is the more natural method of avoiding the diseases. We are now learning to keep the bacteria away from our bodies, either by directly destroying them or by keeping away from the contaminating material. When we know the exact nature of an infectious disease, — what are the habits of the organism which produces it; where they are most likely to be found lurking during epidemics, whether in water, food, clothing, drains, in the air, in the excreta or scales from the skin of the patient; in what conditions they will grow, and what will kill them; how they make their way into the healthy body, whether by food, drink, by breathing, or by contact of infected material with the skin, — in short, when we understand the natural history of an infectious disease, it is usually easy to avoid it. If the disease is taken in drinking-water, it may be avoided or rendered harmless; if in food, the food may be cooked; if from excreta or clothing, they may be easily disinfected by some of the effective germicides; if by contact with the skin, care in handling the infected material, and disinfecting the skin afterward, will usually suffice. As yet we have discovered no way of avoiding contagion which comes to us in the air, but we are just beginning to find out the extremely important fact that the air does not become contaminated with bacteria unless they are allowed to dry. Recent investigations have shown a smaller number of bacteria in the air of a well-kept sewer than in that of a poorly ventilated schoolroom. It is a valuable discovery that this means of infection by breathing — a means which we cannot guard against — is uncommon. The air is not the ordinary mode of transferrence of germs, and would be scarcely at all, if proper precautions were taken to prevent infectious material from drying. Here we immediately get suggestions as to the management of the hospital and the sick-room, and as to general sanitary measures, which will enable us to stamp out many of our most dreaded diseases. How suggestive to remember the experience of Professor Koch and his associates! While at Alexandria, although surrounded by the cholera epidemic, they had no difficulty in avoiding the disease by the adherence to certain precautions which a knowledge of the germ nature of cholera had taught them; but upon return to Germany, and being thus many hundreds of miles from the disease, one of them acquired the disease by a careless handling of the cholera germs which they had brought with them. What better proof could there be of the value of knowledge of the facts? By study of bacteria we are beginning to understand why one disease is contagious and another not contagious, or why a third disease may be sometimes contagious and at other times not at all so. We are learning what are the sure and what the worthless methods of disinfection. Thus the mysteries connected with infectious diseases are disappearing.

It is not of very much value to know the simple fact that a particular disease is parasitic in its nature, unless this is made the basis of further intelligent observation. Nor does it help us any, as Dr. Hunt recently pointed out in this journal, to be able to distinguish the specific germ producing any disease if we end our observations with this discovery. It is of great value, however, to know the habits of the microbe and the conditions in which it can live, and these facts can only be discovered by the study of the microbe itself. This is the share which the biological laboratory must have in the matter. It is of course necessary to study the disease itself, and the conditions under which it propagates itself, with vigor; to study the origin of epidemics, their spread and decline; but this can only be done intelligently when we understand the nature of the organism producing it. When we know the habits of a microbe, — whether it lives in acid or alkali solutions, whether in filth or cleanliness, whether best in heat or cold, etc., — then we can successfully ask questions concerning the conditions in which the disease develops; then we can discover the history of the organism from the time it leaves the body of the sick person until it gets into a second individual and again produces its disease; then we can learn what conditions favor and what hinder the disease; then we can discover how to prevent this transferrence, how to kill the microbe in its passage; and then we shall have gone far toward ridding the race of our vigorous epidemic diseases. Sanitary measures need no longer be blind methods applied tentatively, but may proceed directly at the root of the disease from a knowledge of its cause. Sanitary science must indeed be founded upon the knowledge of the nature and habits of microbes.

Advance along these various lines of preventive medicine has been rapid in the last few years, and is becoming more and more so, and chiefly through the study of facts discovered in connection with the growth and distribution of microbes. Although many questions still remain unanswered, the knowledge of the parasitic nature of infectious diseases is enabling doctors and scientists together to ask intelligent questions concerning such diseases, and to search for their answers in the right direction. Until this knowledge had appeared, such questions and researches could only be made at random. In short, the knowledge collected concerning the parasitic nature of disease and the habits of the specific microbes is giving us hundreds of ways of fighting the diseases outside of the body, even though it has yet not been very fruitful in directing our physicians how to treat the disease when it has once vigorously attacked the body.

The importance of a general understanding of the facts connected with the discoveries in this direction cannot be overrated. Who is there, old or young, who would not be benefited by a knowledge of the source and cause of infectious diseases? Who is there who is not better prepared for life by a knowledge of what is meant by cleanliness, and why it is so desirable, particularly in time of epidemics, to keep our surroundings perfectly clean? Ought not every one understand as far as possible where the infectious organisms are likely to be, and how they may be avoided? Indeed, is not this subject one of the many which we are beginning to recognize as desirable in our public-school teaching? Physiology is taught now in our schools by law, but what branch of physiology can be of more value to the public than a few principles connected with infectious diseases, and the means of keeping contagion away from our doors? If physiology is to be taught in the schools, would it not be well to include in it some such principles of vital importance, instead of compelling the student to learn the names of the bones in the body? At present the public gets informed in such matters only through the uncertain medium of the press, which contains as much false science as true; and as a result it is almost impossible rigidly to enforce sanitary measures. It is needless to say that the public schools have not yet taken up the subject. Our colleges, too, ought to see that every student knows something of this matter. A few of them already realize the fact, and have made a beginning in this line. Our training-schools for nurses ought certainly to put much force upon this subject and the practical precautions connected with it. But, after all, we must look primarily to our medical schools for teaching in this direction. Doctors will always be regarded as authorities in matters connected with health, in spite of nurses or the sayings of scientists; and it is through them that the public must receive its education. The medical schools must therefore lead in this matter. It is true that medical schools aim to teach chiefly how to cure disease, and as yet the germ theory has not materially aided in this direction. It is of course difficult to find time, in the already crowded course, to introduce any new subject not directly related to the cure of disease. But bacteriology is a subject too important to be neglected: it readily forms a part of pathology, and most schools do find time for a treatment of this subject. Our medical schools are now pushing on in this direction. Two or three years ago the theory was dismissed with a word, even in our best schools; and that word was frequently one of ridicule. Now many of the leading medical schools pay considerable attention to the subject. Several of them have among their faculty special bacteriological students who give instruction in this line. A few have well-equipped bacteriological laboratories, and others are looking in the same direction. To what extent the subject is treated in the medical schools of the country in general, or in the training-schools for nurses, cannot be stated at present. Inquiries are being set on foot in this regard, the results of which will appear in some future numbers of this journal.

H. W. Conn.

AMERICAN SOCIETY OF NATURALISTS.

The annual meeting of the American Society of Naturalists was held in the Peabody Museum, New Haven, on Dec. 27 and the two following days. The object of the society is to help instructors in the natural sciences by discussing the methods of research and of instruction. Leaving to the other scientific associations the function of presenting and discussing results, this society, composed of professors and specialists, devotes itself to the publication of new methods, improved apparatus, and aids to science-teaching, all of which are apt to be scattered through various periodicals, and thus fail to secure that general adoption which a practical demonstration of their usefulness would bring about. The work of the society falls into two sections, — biology and geology, — and a day of each meeting is devoted to each of these topics, while the third day is given over to a general discussion upon some attractive subject. The society, though in existence only for a very few years, has a large membership, including in its list many of the eminent leaders of science in this country and in Canada. The attendance at the recent meeting was quite large, and the proceedings both interesting and profitable.

The proceedings were opened by the address of the president, Dr. Harrison Allen of Philadelphia. His subject was 'The Inconstant in Biology,' and was devoted to the discussion of variations in animal structure not easily referable to any law, but to which careful study would attach considerable significance. In particular, he called attention to the prevalence of hairy parts and of color-spots in animals that had to a greater or less extent deviated from their normal type. If, for example, a variety broke from the prevailing color of its kind, the original color would be retained at certain very definite spots: these are found at the tip of the tail, another around the eyes, a third on the skin covering the dorsal column, and elsewhere. The peculiar constancy of these places of retention of the original color was especially emphasized, and the inference drawn that here was something too deep for natural or other selection to weed out, and the explanation of which would be a valuable contribution to the history of animal life. Dr. Allen illustrated his propositions with a series of mounted specimens, and brought out an interesting discussion upon color-markings in general.

Dr. Oliver exhibited a series of carefully prepared wools for the detection of color-blindness and of sub-normal color-perception. Professor Gage described an easy method of injecting the thoracic duct and of demonstrating it for students. Professor Osborn exhibited some sections of the brain and spinal cord prepared by a method that allows of more accurate work than has hitherto been possible. Dr. Minot exhibited a new microtome of his own invention, for which he justly claimed some important advantages. In this the knife is stationary, and by a simple motion of a wheel the thinnest sections can be automatically cut as accurately and as rapidly as desirable. The instrument will be supplied by the Educational Supply Company, Boston. Prof. H. N. Martin showed a very simple device by which either the closing or the opening shock could be separately used for stimulating nerve-muscle preparations in physiological work. A very interesting paper was that of Prof. S. F. Clarke, presenting a classroom demonstration of variation in nature and under domestication. By a series of stuffed fancy pigeons the very varied and fantastic forms of variation that the will of man could bring about was most beautifully impressed; and in striking contrast to this was a series of sparrows, the distinction between which required the closest observation, but which represented no less than eight genera and thirteen natural species. Prof. E. S. Morse, with his usual happy manner, *résuméed* the kinds of museum show-cases employed in Europe, and accented the points of value in each.

To the general student of science the discussion upon science-teaching in the schools, to which an entire day was devoted, would form a most interesting feature of the meeting. The discussion was introduced by Prof. Ramsay Wright of the University of Toronto, who briefly sketched the admirable system of science-teaching in the schools of Ontario. Here the whole educational system is in charge of a minister of education, who has at his service the advice of the university professors, and who, with their aid, has drawn up a schedule of instruction in science which is utopian compared with any thing that exists in the schools of this country. Here the fact that the government controls the granting of certificates and the appointment of teachers has solved the problem of securing able science-teachers for the schools.

Prof. Alexander Winchell of the University of Michigan followed with a forcible plea for the educational value of the study of geology. He claimed for this study the discipline of all those powers of the developing mind upon which a true culture was based. In the child, observation, training of the senses, was the first natural process; and this it was, too, that geology first demanded. With the growth of mental powers came the wider field for their employment, in the induction of the general geologic principles from the observed facts, in the grand deductions from these, and in the exercise of the imagination that geological periods make necessary. He would thus urge the teaching of geology in the elementary schools; and, because this study afforded such varied opportunity for the exercise of all the faculties proportionate to the natural order of their development, he thought it proper to speak of a geological culture.

The next contribution to the discussion was by Professor MacCloskie of Princeton College. He urged in a very emphatic manner the rights of science as opposed to the word-knowledge and the language-culture, that absorbs so much of school time and energy. While the position urged was not a new one, it very forcibly expressed the independent right of science to a very early and important place upon the curriculum of every school. The discussion was concluded by Professor Rice of Wesleyan College, who presented a masterly exposition of the theoretical and practical advantages of science-teaching in the schools. The boy or girl that has not been spoiled by artificial means is invariably interested in the phenomena of nature surrounding him or her on all sides. It is with reference to these that their questions are asked, and it is in the observation of these that they find a satisfaction of their natural curiosity. The current methods of teaching in large measure crush this natural interest, and substitute for it an unnecessarily stupefying word-drill. The result of this is that young men come to the higher schools with a total lack of appreciation for the world of natural fact, and, what is worse, a dulling of all the faculties by which such an appreciation can be attained. It is not the facts of science, but the appetite of the mind for this kind of knowledge, that is to be ever kept awake, and without which that new sense for the teachings of nature cannot be fostered.

All these papers brought out an animated and profitable general discussion from various members. The sense of the meeting was unanimously in favor of the views expressed above; and the advantages of introducing science into the elementary schools was urged not only for its practical value, but for its satisfying the requirements of the natural growth of mind and its general disciplinary value. That children properly trained to an interest in the affairs of science do really bring to their more mature years an appreciation for true science, and the ability to carry it on to a high grade of cultivation, has been proved more than once. On the practical side the question of the order of the sciences in school-work was discussed, and the general opinion was in favor of systematic botany as the topic with which to begin, then physiology, and then physical geography. A complete course in physiology, however, must be based upon some knowledge of physics and chemistry. A committee was appointed to consider the preparation of a schedule of science instruction for the schools, and was authorized to report in full at the next meeting of the society.

The geological part of the proceedings was opened with a paper by Prof. James D. Dana, who recounted some of his recent observations on the Hawaiian volcanoes with especial reference to the connection between seismic phenomena and lava eruptions. The rarity of explosive action, so common in most volcanoes, is well known to be the most distinguishing feature of the Sandwich Island craters. The mountains are nearly pure lava-cones, and the eruptions are fissure eruptions. In only two of the numerous recorded outbreaks, viz., in those of 1868 and 1887, have earthquakes of any violence been noticed. These shocks increased regularly in intensity, and were abruptly terminated with the appearance of the lava. Professor Dana concludes that they were produced by the forcible rending of the solid crust, caused primarily by the vapor tension from water heated from the outside of the lava-conduit; and secondly by the hydrostatic pressure of the lava itself within the conduit. In most cases the formation of the fissure through which the lava is extruded is accomplished so quietly that the first intimation of an approaching eruption is the red glow of the molten mass. In conclusion an interesting comparison was drawn between the quiet type of lava-flow prevalent at the Sandwich Islands and the violently explosive outbursts like those recently exhibited in Java and New Zealand.

A paper by Mr. C. D. Walcott of the United States Geological Survey described an ingenious method of measuring the thickness of inclined strata.

Professor Dwight described an admirable machine, devised by him, for cutting large sections in any plane through fossils. For this purpose a Kerr diamond saw is mounted horizontally, and held rigidly in a plane by two disks carrying small wheels which are in contact with both surfaces of the saw. The specimen to be cut is mounted and adjusted so as to bring any plane against the saw with an even pressure. A solution of soda was recommended as a lubricator.

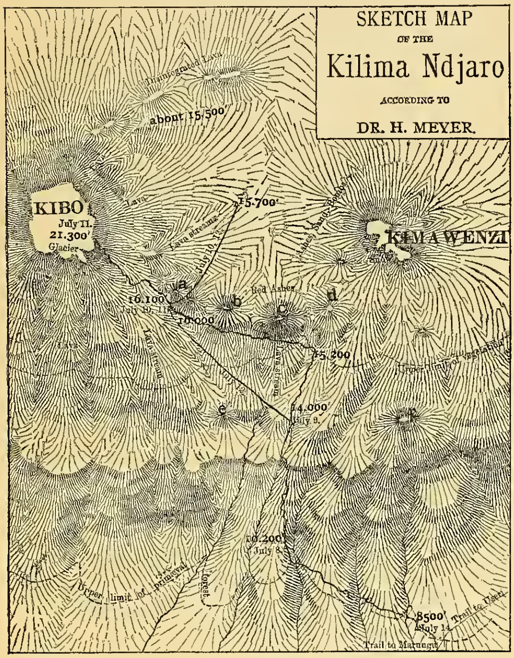
Prof. W. O. Crosby sent a paper upon the method of teaching mineralogy and lithology at the Massachusetts Institute of Technology. The last paper was presented by Dr. G. H. Williams, on the educational value of micropetrography, and illustrated by the exhibition of a new microscope of American manufacture, designed especially for students in this subject.

A resolution was passed to request Congress to remove the duty on scientific books and apparatus, and to join with other associations petitioning for this change in the laws. Professor Marsh was elected an honorary member of the society, to fill the vacancy left by the death of Professor Baird. Dr. Allen was re-elected president, and Professor Clarke secretary. The next meeting will be held in Baltimore.

EXPLORATION AND TRAVEL.

Dr. H. Meyer's Ascent of the Kilima Ndjaro.

IN a letter to the Geographical Society of Leipzig, which has been published in *Petermann's Mitteilungen*, Dr. H. Meyer describes his ascent of the Kilima Ndjaro. On July 2 he left Taweta, and, after a two days' march through steppes and brushes, he reached, in company with Herr von Eberstein, the village of Mareale, a chief of the Marangu. He was kindly received, and Mareale gave him three guides, with whom and twenty-two men of his caravan he started for the Kibo, the higher summit of the Kilima Ndjaro. At a height of 5,700 feet they passed the last plantations of bananas, and entered the primeval forests, which are always full of mist, at a height of 6,600 feet. After two days, having passed these forests, they reached the grassy belt surrounding the upper part of the mountain. Here they left the trail which leads along the south-eastern slope of the Kimawenzi to Useri, and turned north-westward, following the upper limit of the forests. At the end of the second day they reached the place where, in 1884, Johnston had staid for some time, at a height of 9,800 feet. Here part of the caravan remained, but eight men volunteered to carry tent, blankets, instruments, and provisions to the snow-line. The route led over grass-covered streams of lava, which were intersected by gulches of 150 feet depth, cut by the torrents which come from the snow-fields of the summit. From here the saddle between the Kimawenzi and Kibo appears almost horizontal. The travellers ascended a lava-stream, and soon reached a gently sloping region where meadows indicated the course of the brooks. Here the first patches of snow were met with, and Meyer left here his tent on the 9th of July, at an elevation of 14,000 feet.



On the 10th, when Meyer intended to strike camp, five of his servants refused to accompany him any farther, and therefore they were left behind, while the rest of the caravan continued their march. After a short time they reached the steep, fissured hill *c*, from which the lava-stream had come on which they travelled the preceding day. Here they discovered the series of parasitic craters *a*, *b*, *c*, *d*, from which numerous lava-streams have flowed southward. Some of these are separated by deep valleys, while others form a continuous plateau which stretches out far northward between the Kimawenzi and Kibo. Meyer proceeded near the southern part of these hills at a mean elevation of 16,000 feet, and made his last encampment at the foot of the hill *a*. As the night promised to be very cold, he sent his three negro servants back to the previous camp, and ordered them to return the next day. Thus he and Von Eberstein were alone, and passed the following night at a temperature of —11° C. (12° F.) in their small tent. After a careful examination of the cone of Kibo with a spy-glass, Meyer concluded that an ascent on the south-eastern side was possible. But on the highest summit a light blue wall of ice was seen, which extended to a lower level on the south side of the mountain. In the beginning of the next day, after having passed lava-streams covered with large bowlders, the travellers reached continuous steep snow-fields filling the rounded valleys between enormous lava-streams. Johnston had reached this point, and a little farther to the north Count Teleki had attempted an ascent a few weeks before Meyer's arrival. In the morning the weather was clear, the snow hard, and therefore the travellers succeeded in reaching a considerable elevation; but after three hours' climbing, fog set in. In the beginning the mist was light, and the summit of the mountain could be seen occasionally. Wherever a lava-stream crosses an older one, a new snow-field begins, steeper than the preceding. At such points the travellers staid for a few minutes, making barometrical observations and collecting rock specimens and lichens. They were careful not to ascend too rapidly, as work in elevations of more than 17,000 feet in height is extremely exhausting. Later in the day the fog became thicker, the highest parts of the mountain became invisible, and the sun disappeared. The temperature fell from 8° C. (46° F.) to —3° C. (27° F.), and a snow-storm set in, which threatened to obliterate the track. About half an hour later, Herr von Eberstein began to fall back, and after a quarter of an hour more his strength left him. As they were not far distant from the rim of the crater, Meyer proceeded alone, and notwithstanding giddiness, breathlessness, and exhaustion, succeeded in ascending the last steep snow-field. Here the slope became less steep, and, after having climbed over a field of gigantic bowlders of ice, he reached the ice wall which he had sighted from the last camp. It is about 100 feet high, and inaccessible without the help of several expert guides and a great apparatus of ropes, ladders, etc. Although Meyer did not reach the rim of the crater itself, he concludes that it is probably filled with ice, as the ice wall projects over it on all sides. After having observed the barometer and thermometer, he returned to where he had left Von Eberstein, who had meanwhile observed the boiling-point thermometer. After a rest of about a quarter of an hour, they continued their descent, and reached their tent after an absence of seven hours. On the following morning the northern part of the saddle was visited for making topographical observations, and, after the three negroes had returned, the party continued their descent of the mountain, and reached Mareale's village after a march of four days.

NOTES AND NEWS.

ON Friday, Dec. 30, a meeting was held at the College of Physicians and Surgeons in New York City for the purpose of organizing an American physiological association. The association has for its object the promotion of physiological research and of social intercourse among the physiologists of the country. The association will meet as a section of the Medical Congress every three years. The meeting was presided over by Dr. S. Weir Mitchell, and many prominent physiologists from all parts of the country were present. A constitution was adopted, and Prof. H. P. Bowditch of the Harvard Medical School was elected president, and Prof. H. N. Martin of Johns Hopkins University, secretary and treasurer.

— The seventh course of free lectures of the Cincinnati Society of Natural History will be given on Friday evenings in January, February, and March, 1888, in the rooms of the society. The following is the programme: Jan. 6, Charles B. Going, 'How the Chemist Works;' Jan. 13, George Bullock, 'Modern and Orthochromatic Photography applied to Natural History;' Jan. 20, B. Merrill Ricketts, 'The Dermal Coverings of Animals and Plants;' Jan. 27, Joseph F. James, 'The Great Deserts of the Earth;' Feb. 3, Amos R. Wells, 'Volcanoes;' Feb. 10, D. S. Young, 'Some Characteristics of Fishes;' Feb. 17, Charles Dury, 'Reason and Instinct in Animals;' Feb. 24, Walter S. Christopher, 'Bacteria and Fermentation;' March 2, F. W. Langdon, 'Races of Man;' March 9, A. B. Thrasher, 'The Voices of Animals.'

— The Council of the American Economic Association held its annual meeting in Hamilton Hall, Columbia College, at 10.30 A.M., Friday, Dec. 30.

— The *Political Science Quarterly* for December contains several articles that are worth reading, though none of special importance. Two of them are on the subject of profits and wages, — a subject that is sure to attract readers, but on which we cannot say that much light is shed. Professor Clark recognizes the fact, which most economists overlook, that a large portion of the employer's profits is of a mercantile character, arising from buying and selling to good advantage rather than from special skill in production; but, strangely enough, he thinks that this profit is due to causes beyond the employer's control, and "comes to him as rain from the clouds;" whereas it is due in great measure to his skill in taking advantage of the markets so as to buy at a low price and sell at a high one. The opening article of the number is a vigorous attack on the oleomargarine law, and will be read with interest by all opponents of government interference. The article on local government in England is of interest just now, when new and extensive changes in that branch of the English Government are in contemplation. There is also an article of considerable historical interest, on the Constitution in reconstruction, giving an account of the contest between Congress and President Johnson in regard to the recognition of the Southern States and the guaranties to be required of them before such recognition was granted. The closing essay is on India's unadjusted trade balance, and the usual complement of book-reviews fills up the number. This review, together with the *Journal of Economics* issued at Harvard, and the various publications of the Johns Hopkins University, are an addition to our periodical literature; for they furnish a kind of reading that we should otherwise hardly get.

LETTERS TO THE EDITOR.

**** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

Twenty copies of the number containing his communication will be furnished free to any correspondent on request.

The editor will be glad to publish any queries consonant with the character of the journal.

The Flight of Birds.

IN your issue of last week, my friend, Dr. Elliott Coues, takes part in the current discussion of the flight of birds with his usual boldness and independence, but not with his usual care and accuracy. He practically begins his letter with the following *ex cathedra* condemnation of Professor Trowbridge's theory, and denial of his facts: "With regard to the alleged locking of the primaries: 1. It does not take place; 2. Did it take place, flight would be impossible."

As Professer Trowbridge is abundantly able to defend himself, I leave the answer to the above extraordinary statements to him, and will simply remark, in passing, that I know from my own observation that the locking of the primaries can and does occur, either by accident or design, and that when it takes place it does not render flight impossible, as it affects only the extremities of the feathers. It is evident that Dr. Coues has not taken pains to inform himself in regard to the facts brought forward by Professor Trowbridge, otherwise he would not have uttered such dogmatic assertions.

Further on, Dr. Coues decapitates me much in the same way he does Professor Trowbridge; for he says, "The fixing of the wing of a mortally wounded bird in the manner described by Professor Newberry does not bear on the case. It is simply a muscular rigidity due to nervous shock, and of a part with the convulsive muscular action, which, under similar circumstances, results in the well-known 'towering' of hard-hit birds."

We have here other proof that Dr. Coues has not read all that has been said in this discussion: if he had done so, he would have seen that I did not claim that the automatic rigidity of the arm and fore-arm, the 'setting' of the wing, first described by Professor Wyman, had any thing whatever to do with the locking of the primaries. As was said in the discussion of Professor Trowbridge's paper before the Academy of Sciences, and reported in my former letter to *Science*, the spreading and folding, and, according to Professor Trowbridge, the locking of the primaries, are functions of the *manus*, and have nothing to do with the flexion and extension of the arm. The spread of the wings of the turkey-buzzard maintained after death, reported by me in my 'Notes on the Birds of Northern California and Oregon' (*Pacific Railroad Reports*, vol. vi. Zoölogy, p. 74), was certainly not a case of muscular spasm. My report of it will be found at the place cited, and is as follows: —

"For the purpose of examining this bird in California, to determine for myself its identity, or otherwise, with the turkey-buzzard of the East, I took occasion to shoot one which was flying over us in the upper part of the Sacramento valley. He made no motion indicating that he had been struck by my shot, but sailed on with widely expanded and motionless wings, as before. Gradually, however, he began to descend in wide and regular circles, till finally, without a wing-flap, he settled as lightly as a feather on the prairie, and remained motionless. I went to him, and found him resting in the grass, his wings still widely and evenly expanded, but the head drooping and life extinct. It was a male, large, in fine plumage, and apparently identical with ours; then, too late, I regretted that I had been the cause of a death so calm and dignified."

I have been shooting now for a great many years, have killed many thousands of birds, and ought to know what their behavior is when mortally wounded; yet I do not hesitate to say that the extension of the wings in this case and those reported by Dr. Storer was not due to muscular spasm, but to a locking of the wing-bones. Nor had the death of the turkey-buzzard, cited above, any thing whatever in common with the phenomena of 'towering,' as asserted by Dr. Coues. Towering is exhibited only by birds which are wounded in the head, and which, with confused intellects, fly up and up, perhaps till lost to view. I have reported one such case in my notes which is typical, and I here repeat my account of it to show that it was totally distinct from all wing-setting, spasmodic or articular.

"Once when collecting water-birds on San Pablo Bay, California, I shot a gull (*Larus Hermanni*), which fell, apparently dead, upon some rocks near me. When I stooped to pick it up, however, it flew swiftly away, and mounted in circles higher and higher until it disappeared."

The article by Bergmann in Müller's *Archiv für Anatomie und Physiologie* (1839) has no bearing upon the statements made by Professor Trowbridge or myself. It is true that Bergmann describes the sliding of the radius on the ulna, and in the discovery of this anatomical feature he antedates Wyman; but he makes no reference to the 'setting' of birds' wings, which was the special subject of Professor Wyman's note. All Bergmann says about the function of the anatomical peculiarity which he pointed out is, "that it is desirable that observations should be made (for which he had no opportunity) to determine whether it might not have efficiency in the soaring of rapacious birds or in the flight of those which must quickly change the direction of their flight."

In conclusion I will venture to suggest that neither Professor Trowbridge nor myself are such tyros in science as to warrant the didactic tone which Dr. Coues assumes. Professor Trowbridge needs no indorsement from me, but I venture to say that he is one of the most eminent engineers in the country, and that he has occupied himself for many years in the study of the mechanics of animal locomotion, upon which subject he is as well informed as any one living. As for myself, I was for many years as enthusiastic an ornithologist as Dr. Coues himself, and have shot over as much ground, and have perhaps killed as many birds. I was also educated as a physician, and, at the time I made the observations cited above, I was serving as naturalist and medical officer to a detachment of troops.

I would also call attention to the fact, that, for all the interesting information we now have in regard to the structure and functions of the wings of birds, we are indebted, not to ornithologists, but to comparative anatomists: it is therefore quite possible that even Dr. Coues may learn something from one outside his profession.

J. S. Newberry.

New York, Jan. 3.

The communication of Mr. Elliott Coues in the last number of *Science*, on the mechanism of the flight of birds, renders a response from me, in the interest of science, indispensable. This is the more necessary on account of the unavoidable delay which has occurred in the publication of a paper sent by my son to the *Ornithologist and Oölogist*, and which will appear in the next number of that periodical, and also the delay in the publication of the paper read by me before the National Academy of Sciences, and which has given rise to comment and discussion, and is referred to in Mr. Coues's communication.

During the last autumn my son, C. C. Trowbridge, who is now a pupil in the Hopkins Grammar School at New Haven, Conn., and who has for several years devoted much of his leisure time to the collection and study of birds, brought to me a hawk which he had shot while it was soaring, and called my attention to the fact that the four outer primaries in each wing were interlocked; that part of each primary along which the lower margin was cut away lapping over or behind the succeeding primary, which was cut along its anterior or upper margin to permit of this interlocking and crossing of these feathers. This was the condition of the wings when he picked up the bird. The general appearances of the wings were so little altered from their ordinary aspects that the interlocking would ordinarily escape notice. My son suggested that this interlocking has the effect of relieving the muscular action required for the extension of the primaries during long flights, especially in soaring birds, and, further, that it might aid the bird in steering its way while soaring.

This discovery seemed to me of much interest; and after having assured myself by inquiries, and the examination of works on ornithology, that it had not been made by others, I concluded to bring the subject to the notice of the New York Academy of Sciences, and shortly afterwards read a paper in relation to the same before the National Academy of Sciences.

I supposed that all lovers of true science would welcome so interesting a discovery, even though it was made by a boy. Such, indeed, was the reception of the paper by all the naturalists present; Professor Marsh, Professor Newberry, and Professor Cope commending the paper, and Dr. Gill, who was not present, but to whom I had exhibited drawings of a wing, and explained the matter, giving encouraging assent to the novelty and importance of the discovery. I mention the names of these gentlemen, because I do not think they will ever have reason or cause to regret their favorable comments, nor to retract their opinions.

During many years' study of animal mechanics I have found no facts which exhibit more wonderfully and beautifully than those I have described, the mechanical adjustment of the organs of motion to the medium in which motion takes place, and to the conditions for which provision is made.

I have in my possession the wings of two large hawks (*Buteo lineatus* and *Buteo borealis*) in which the effects of the habitual interlocking of the four outer primaries has been to wear deep notches, and to produce permanent wrinkles, in the feathers at the point of crossing or overlapping. These I have shown to many scientific men without hearing a doubt expressed of the object or uses of the emarginate cuttings. These long primaries present a serious resistance, with a long leverage, when a bird is soaring, which would overtax the extensor muscles in long-continued soaring flights, if not relieved by the process of interlocking. That this interlocking does not impede flight, but in a wonderful and peculiar way aids the evolutions of the bird, is evident from the fact that by this interlocking a curvature is given to the anterior edge of the wing, which produces a warped surface, thus enabling the bird to have easy control of the wing with the least possible exertion. A perfectly flat, thin disk, in moving through air, is liable to be violently inverted, or turned broadside to the motion, by the slightest change of angle with the plane of motion. Every one has noticed this when a playing-card is seen to fall through the air. The edgewise position is one of extremely unstable equilibrium. This would be the condition of the outer part of the wing in soaring, were it not for the warped-surface form which, in the wings I have examined, is almost wholly maintained by the interlocking of the primaries, justifying my son's remark that this interlocking is an aid to steering, in soaring flight.

Mr. Coues, in his communication to *Science*, disposes of all this matter by a sententious dictum, which, from his extensive knowledge of ornithology, must be regarded as an extra-judicial opinion, pronounced with much regret, but with the severe force which science and truth demand, in the following words:—

"Much as I regret my absence on those occasions [the meetings at which the papers were read and discussed], I am still more sorry to be obliged to dissent without qualification from the position taken, . . . which is, to my knowledge, quite untenable. . . . With regard to the alleged locking of the primaries: 1. It does not take place; 2. Did it take place, flight would be impossible." And further, "It is fortunate that the mechanism of the wing does not permit the primaries to lock in the manner that has been supposed, for, if it did so, birds could not fly."

I am necessarily provoked, by these unexplained judgments, to test Mr. Coues's knowledge of the mechanism of the wing which "does not permit the primaries to be locked." I have found, by dissecting the wings of the hawks which I have referred to, that in these birds ten muscles are concerned in the movements of that part of the wing which corresponds to the human hand. Among these are three muscles, with their tendons, which have for their object solely the extension and flexion of the four or five outer primaries. The extensor muscles lie between the radius and ulna of the fore-arm, but the tendons run through the wrist-joint and along the hand to the joints of what corresponds in the human hand to the fore-finger, acting solely to extend the four or five primaries beyond any extension which they could otherwise have.

The flexor muscle lies in the hand,—a very small muscle,—with its tendon so attached that its only use is to flex the four or five primaries through the small angle by which they are extended by the opposing muscles just described. These muscles are not referred to, nor described, in Mr. Coues's admirable and voluminous work on ornithology, and I beg that he will inform the readers of *Science* where specific descriptions of these particular muscles, and their uses, can be found.

There are two other muscles whose tendons are so attached to the joints of the wrist, in the specimens I have, that when the wrist is extended or flexed by the larger extensors and flexors, a partial rotatory motion outwards and inwards may be given to the whole hand. May I ask Mr. Coues where I can find specific descriptions of these muscles, and their uses? These several muscles are principally concerned in the mechanism which does permit of the locking of the primaries.

Mr. Coues discusses another matter in his communication which has only a very general bearing on this question of the primaries. It is the automatic or concomitant extension and flexure of the wrist in birds when the elbow is extended or flexed. In the specimens which I have examined, I have found an inelastic tendon, without a muscle attached, fastened at one end to the humerus at the elbow, and at the other to the hand at the wrist, which is an essential feature in this purely kinematic combination. Moreover, this tendon, or string, plays another important part in acting as a string to the bow of the ulna, and taking the strain which might break the ulna, when the bird strikes the air strongly, but for this remarkable support. This is not referred to in Mr. Coues's work, and I would ask him where I may find its description.

Finally, will Mr. Coues explain *why* birds cannot fly when a few inches in length of the outer primaries lap over and behind others? Mechanically this makes a very strong wing, admirably adapted to soaring flight, for which it is evidently intended; and in one instance, at least, which I have given, the bird did apparently fly very well and very naturally with its primaries thus interlocked.

Moreover, from my own experiments with wings, both before dissection and after the muscles and tendons have been exposed, so that they might be operated by hand, I am convinced that the interlocking of the primaries is a simple and easy operation, entirely under control of the bird, and with many birds is habitual.

W. P. Trowbridge.

New York, Jan. 3.

Eskimo and the Indian.

The criticisms of Mr. Chamberlain's letter (*Science*, Dec. 2) by Dr. Boas and Mr. Murdoch are sound, forcible, and instructive; but these critics have confined their strictures wholly to the Eskimoan words. So, using the alphabet adopted by the Bureau of Ethnology for recording Indian languages, I will point out some errors made by Mr. Chamberlain in the words of his comparative list taken from the Iroquoian languages.

After making due allowance for the rude and imperfect 'orthography' of the words, it is necessary to say that *ata* ('father') and *ekening* ('woman') are not Tuscaroran terms; that *nup* ('die') and *nibey* ('water') are not Mohawk words; that *aitaa* ('father') is not Huron: these vocables, having these forms and with these meanings, are not Iroquoian.

(1) *kwe'-nis*, and not *quennies*, is the correct form of this term for 'copper.' It is evidently the word 'penny' or 'pence' (possibly *penning* or *peningens*), adopted by the Iroquois, and adapted to their own peculiar utterance. In earlier times they most invariably substituted *kw* for *p* or *b*, because these sounds did not occur in their speech.

(2) *kă-nă'-tcyă'* is the proper form of *kanadzia*, and, being predicative, it signifies 'it is copper,' and not simply 'copper;' it also means 'it is a pot or kettle,' and is more frequently used in this latter sense. Its derivation is not clear, but, in accordance with the genius of Iroquoian speech, it presupposes the nominal or substantive form, *o-nă'-tcyă'*; this, in turn, points to an earlier *o-nă-tcyo'-kwe*, — a form still extant in some of the cognate languages, and which form is evidently from the predicative *ye-nă-tcyo'-kwă'* ('one cooks rice (wheat) by which'), undoubtedly referring to the cone-bottomed earthen 'pots' or 'kettles' so used. The circumstance that unburnished copper resembles very much these clay 'pots' in color would quite naturally serve as a distinctive characteristic by which to describe this metal. *Kă-nă'-tcyă'* as a predicative signifies either 'pot' or 'copper,' but as a substantive, only 'pot,' which is probably its oldest meaning.

Mr. Chamberlain compares the preceding two words with the Eskimoan *kannooyak* ('copper'). One of the two is clearly of European origin, and the other is possibly, but not probably, related to the Eskimoan term.

(3) *e'-hne'-kĕñ* is the proper orthography of *ehneken*. It is a derivative term denoting 'above,' 'on the surface.' Its probable original signification is 'sun-ward,' 'sun-side,' or 'toward-sun.' It certainly never meant 'sky' in Iroquoian speech; but the Unalashkan *innyak* with which it is compared means both 'sky' and 'above' in the list.

(4) *o-nĕñ'-yă'*, and not *onna*, is the proper Iroquoian word for 'bone.' The Eskimoan *hrownik* ('bone') has clearly no 'fortuitous coincidence' of sound with it.

(5) *he-'gĕñ'-hă*, and not *haenyeha*, is the proper form of this Iroquoian expression. It signifies 'my younger brother' (literally, 'my brother small'), and not simply 'brother.'

(6) *tcyă'-tă'-te-kĕñ*, and not *jattatege*, is the true form of this vocable: it means 'ye two are brothers to each other,' and not 'brother' alone. The Eskimoan *anayoa* ('his elder brother'), *anaga*, and *agituda* have clearly no evident similarity of sound or meaning with the two preceding Iroquoian words, *he-'gĕñ'-hă* and *tcyă-tă'-te-keñ*.

(7) *she-yĕⁿ'-hă*, and not *cheahhah*, represents the orthoepy of this predicative term, which means 'thy daughter,' and not simply 'child.' Literally it signifies 'thou one hast small.' The Eskimoan word *iyaye* ('child') has no apparent affinity here.

(8) *e-nĭ'-se-ră'*, and neither *eghnisera* nor *ennisera*, is the proper form of this word, meaning 'day,' a form used mainly in composition. It is a derivative form of the word *ĕñ-tă'* or *e-nĭ'-tă'* ('day,' originally 'sun'). The Eskimoan *anyark* evidently means 'a long day,' and not simply 'day.' No similarity of sound or meaning appears here.

(9) *koñ'-nĭ's* (meaning 'I make, build, or render it,' and not simply 'do') is a better form of *konnis*. *K* for *ka-* ('he — it'), *-oñ-nĭ'-* ('make,' 'build,' or 'render'), *-s* (terminative sign of customary action), — this is the etymology of the word, which has no similarity of sound or meaning with the Eskimoan *tcheneyoaq* ('he works').

(10) *shĕⁿ-tĕ'ⁿ'-kyĕ*, and not *suntunke*, represents the proper pronunciation of this word: it means 'on or against thy ear,' and not simply 'ear;' the initial *s-* is the sign of the second person possessive, *-'kye* is the locative, and *-hĕⁿ-t-* is the noun stem or root. The Tchuktschi *tchintak*, or correctly *siuta* ('his ear'), apparently has no affinity with this word.

(11) *e-nyĕñ'-kyĕ*, and not *ayinga*, misquoted from *eyingia*, is the correct form of this word, which signifies 'on or against one's hand,' and not 'finger,' as does the Tchuktschi *aihanka*, with which it is questionably compared.

(12) *yu'-năks*, and not *yoneks*, means 'it is burning,' and not simply 'fire,' as in the list: *yu-* ('it'), *-'năk-* ('to burn'), *-s* (the terminative sign of customary action). The Eskimoan *oonoktook* ('fire' or 'to burn') has but a doubtful claim to relationship with this word.

(13) *o-sĭ'-tă'*, and neither *achita* (Huron), nor *ochaita* (Onondaga), is the correct form of this vocable, meaning 'foot.' The stem or root of the word is *-sĭ'-t-*, a stem that never meant 'hand.' The Eskimoan *etscheak* or *arkseit* ('foot' or 'hand') has certainly no evident affinity with this word.

(14) *yo-yă'-nĕ-re'*, and not *ioyanere*, is the true form of this term or expression, which signifies 'it is good' affirmatively: thus, *yo-* ('it'), *-yă-nĕ-r-* ('the good,' 'the right,' or 'the noble'), *-re'* ('to have or possess'). The Eskimoan *ayunitork* or *ayunitsoq* means 'not bad,' and so 'good' negatively. These two words evidently have no affinity nor a common origin.

(15) *os-o'-tă'*, and not *chotta*, is the proper form of this word, denoting 'hand.' With this meaning it is common to only two of the Iroquoian languages. Originally it meant 'finger,' signifying literally 'hand-protruding-thing.'

(16) The orthography of *noatsshera* is so uncouth that it is very difficult to discover its meaning. It does not mean 'head,' but 'hat' or 'scalp-covering.' It is properly written *o-no-he'-tcră*, which form has no relation whatever to Tchuktschi *naschko* ('head').

(17) *o'-'skwă'*, and not *hechkwaa*, is the proper orthography of this term for 'lip.' It bears no resemblance to the Eskimoan word *kakkiviar* ('lip'), with which it is compared.

(18) *e-'nĭ'-hă*, and not *enihah* nor *aneehah*, is the proper spelling of this word, which means 'one is male,' but never 'man.'

(19) *oñ'-kwe*, but not *onquich*, is the correct form of this term, which denotes 'homo,' 'man,' 'a human being,' but never 'male,' to distinguish sex. This word, and *e-'nĭ'-hă* above, have no root in common: so, having no literal meaning common to both of them, they should not be compared with one and the same word. The Eskimoan words *angut* and *innuk* ('man') are not related, and why compare them with two Iroquoian terms (*ĕ-'nĭ'-hă* and *oñ'-kwe*) likewise unrelated to each other?

(20) *ĕⁿ'-nĕⁿ'* represents the true form of *anehah* (Huron), *eanuh* (Tuscarora), *ana* (Nottoway), and means 'my mother,' not simply 'mother.' The root of the word is *-ĕⁿ-*, which signifies 'mother.' It is my belief that it is related to *-oñ-nĭ'-* ('to make or produce,' 'to build or render').

(21) *o-nyoñ'-să'*, not *yaunga*, is the true form of this Iroquoian word for 'nose.' It has no apparent affinity to Tchuktschi *chinga* ('nose').

(22) *kwĕⁿ-tă'-ĕⁿ*, but not *quechtaha*, is the correct form of this Seneca-Iroquoian word, meaning 'red.' It is compound, and evidently signified 'it is blood-marked,' and so 'it is red.' There is an evident metathesis of the first and second syllables. The Tchuktschi *kawachtuk* ('red') clearly has no affinity whatever to this word.

(23) *ă-wĕⁿ-nă'-să'* and *ă-wĕⁿ-tă'-sĕ* are the forms of *ennasa* ('tongue') found among the Iroquoian languages. They do not, however, resemble the Unalashkan *ahnak* ('tongue').

(24) *o-nye'-yă'* and *o-ni-ye-te* are the true Mohawk forms of *ouniyeghte* ('snow'); *o-nĭ'-yă* is the proper Seneca form of *onyeiak* (also 'snow'): these words have no apparent relation to Tchuktschi *annu* or *annju* of the same meaning.

(25) *so'-rak*, not *soluck*, is the true Mohawk word for 'duck.' The Eskimoan word for 'duck' is *tchorlerk*.

(26) *o'-she*, and not *oxhey*, is the correct form in Huron of this Iroquoian word for 'winter' or 'year.' Its stem is *-sh-*, and means 'snow.' The Eskimoan *ukshiok* and *uktschuk* have no apparent affinity or relationship with this word.

Thus, in comparing thirty different words taken from the several Iroquoian languages, there is scarcely a single instance in which Mr. Chamberlain has not misapprehended the true sound and real meaning of the words.

Before an effective or satisfactory comparison between the words of two languages, or of two families of languages, can be made, the investigator should possess at least an elementary knowledge of both, a knowledge of their rules of etymology and syntax, and of their laws of vocalic and consonantic change. This is especially true with reference to the languages of the Iroquoian peoples. These tongues are among the most difficult of Indian languages to investigate and to understand.

To a want of knowledge of these facts, and to the use of faulty vocabularies, are evidently due Mr. Chamberlain's errors. An attempt to establish the affinity and common origin of two languages upon material so faulty as that criticised is scarcely likely to be successful. J. N. B. HEWITT.

Bureau of Ethnology, Washington, D.C., Dec. 26.

The Study of Languages.

YOUR correspondent, H. L. E., asks in the last issue of *Science* whether there is any practical method of learning to read a language without the use of a dictionary. The present writer has learned to read readily two languages without the use of either dictionary or grammar, and believes his method not only possible, but the better way, when a knowledge of the language, not its grammar, is the one desired. His plan has been to begin with some easy author, and follow its text closely while some one reads aloud an English or some other familiar translation. By following such a plan through a dozen or more books, one may then venture on some simple author, dispensing with both dictionary and translation so far as possible, and learning the meanings of the new words, as they appear, from the context. After having read twenty or thirty novels or similar works in this way, he should begin the study of the grammar, and will then be surprised to find that conjugations and declensions are no longer a task. After one has learned a language, a dictionary is very useful; but he certainly can never get a thorough and exact knowledge of the meanings of words from English synonymes. W.

New Haven, Dec. 30.

Conspiracy of Silence.

THE following statement, made by one of your correspondents (*Science*, x. 309) — " But a general conspiracy among men of science to suppress views because they are new and unacceptable to old fogies, is impossible; and your correspondent and the Duke of Argyll must certainly know that fact, and it will remain a fact, in spite of any number of instances of special local repression that can be cited" — is a logical curiosity. Whether or not the general conspiracy exists can only be known by examining the local action in special cases which may arise; but we are told, that, whatever be the result of this examination, we must recognize the impossibility of such a conspiracy. This is decidedly a new process of scientific demonstration. Old Poz, who remarked, " I've said it, and that's enough to convince me," was accustomed to reason in this manner.

The same correspondent states, speaking of Mr. Bonney, " What he meant in his rebuke of the Duke of Argyll is evident: he meant that any one man of science not engaged in a given special line of research can not and dares not make up his own mind as to the validity of one of two opposing theories until those others who have that special line of research in hand have practically reached some consent on the subject."

This is the true ecclesiastical method, to which Mr. Bonney objected. It is the method of the child in the song, who says, —

" I believe it, for my mother told me so."

It is the method of the man who has a profound reverence for authority, so well pictured by Thackeray: —

" So, as he had nothing to say in reply, he began to be immensely interested in the furniture round about him, and to praise Lady Clavering's taste with all his might.

" ' Me, don't praise me,' said honest Lady Clavering, ' it's all the upholsterer's doings and Captain Strong's, they did it all while we was at the Park — and — and — Lady Rockminster has been here and says the salongs are very well,' said Lady Clavering with an air and tone of great deference.

" ' My cousin Laura has been studying with her,' said Pen.

" ' It's not the dowager: it is *the* Lady Rockminster.'

" ' Indeed!' cried Major Pendennis, when he heard this great name of fashion, ' if you have her ladyship's approval, Lady Clavering, you cannot be far wrong. Lady Rockminster, I should say, Arthur, is the very centre of the circle of fashion and taste. The rooms *are* beautiful, indeed!' and the major's voice hushed as he spoke of this great lady, and he looked round and surveyed the apartments awfully and respectfully, as if he had been at church."

It may be that the views imputed by Mr. Lesley to Mr. Bonney are correct, but this would not be suspected from the latter's published words: and it looks as if Mr. Bonney's defender, in his zeal, has given away Mr. Bonney's case, and the scientist's case in general, more completely even than was done by Mr. Bonney himself.

RICHARD H. BUEL.

New York, Dec. 30.

Color and Other Associations.

IN a note on color and other associations, which I wrote, and which was printed in *Science* (vi. 1885, p. 242), I gave the colors which my daughter Mildred (then a child eight years old) associated with the days of the week, with the numerals 1–10, and with the letters of the alphabet in 1882. I stated that I found the same colors associated with the same forms in 1885. I have lately questioned her again, and I find the same colors are still associated with the same forms in nearly every case. Saturday's color has changed from pure white to cream color; F has changed from black to brown; Q, which had no certain color, is now called purple; X and Y, which had not much color, are now called red and cream color (Q, X, and Y are now more frequently in use than then); 8, which was white, is now called cream color (a similar change to that of Saturday); and 9, which was called ' greenish?' is now called blue. With these few exceptions, the same colors have been constantly associated with the same days, numerals, and letters from 1882 to 1888, — six years. This case appears to me now, as formerly, to deserve record in connection with the observations of Galton and others on the subject.

EDWARD S. HOLDEN.

Berkeley, Cal., Dec. 20.

Thomas Braidwood and the Deaf-Mutes.

IN a footnote to a page of Sir Walter Scott's ' Heart of Mid-Lothian,' I read, " ' Dumbiedikes' is really the name of the house bordering on the King's Park (Edinburgh), so called because the late Mr. Braidwood, an instructor of the deaf-and-dumb, resided there with his pupils."

Now, I happen to know that Thomas Braidwood sold his estate (that goes by the name of our family, and is situated next to the Duke of Hamilton's, some twenty miles beyond Glasgow) in order to use the proceeds to start his institution for educating the deaf-and-dumb; and if Professor Bell, in his address at the Gallaudet anniversary, a notice of which is published in *Science* of Dec. 23, meant it as a reproach to the memory of Mr. Braidwood, when he says the school " was a money-making institution," and that its principal " had bound all his teachers under a heavy fine not to reveal his methods to any one," it may be pertinent to ask if, under the circumstances, it was not only prudent, but a duty of Mr. Braidwood, to make his institution pay its own way. His all was involved in it; and, had he not used what some people would call a necessary precaution, his school might have perished for want of funds, and himself been impoverished. At all events, that is the view his relations take of the matter.

And when one reviews the dreary centuries preceding, when every now and again some gentle soul proposed to educate the deaf-and-dumb only for it to drop out of thought again, perhaps it would be best to guard with caution the acts of him who staked his entire wealth in the venture, and spent forty-six years of life in establishing as a living fact what was but as a grand dream for centuries.

THOMAS W. BRAIDWOOD.

Vineland, N.J., Dec. 29.

BOOK-NOTES.

—Every year Hood's Household Calendar takes a step forward, as its ingenious publishers strike some new thought in style and arrangement. For 1888 Hood's Calendar has the 'cut-out' head of a young girl surrounded by a blue hood, making a very beautiful and attractive picture. The coloring is wonderfully well done, and the pad, also printed in colors with a special design for every month, helps make up a very artistic calendar. Three millions of these calendars are issued, and all our readers should have one. Ask your druggist, or send six cents in stamps to C. I. Hood & Co., Lowell, Mass.

—Messrs. W. S. Kimball & Co.'s (Rochester, N.Y.) straight-cut cigarettes are manufactured from the finest, most costly, and brilliantly colored natural leaf, and warranted absolutely pure, and by comparison will be found unequalled. A selected force of the highest skilled workmen only, are employed in their manufacture. Each cigarette bears their imprint and brand, in watermark, thus: 'W. S. Kimball & Co., Straight Cut.'

—Alice W. Rollins will contribute a paper to the January *American Magazine*, on manual training in schools.

Publications received at Editor's Office, Dec. 19-31.

DAWSON, W. Note on Fossil Woods and other Plant Remains, from the Cretaceous and Laramie Formations of the Western Territories of Canada. Ottawa, Trans. Roy. Soc. Can. 7 p. 4°.
MAENNEL, R. Veränderungen der Oberfläche Italiens in geschichtlicher Zeit. Part I. Das Gebiet des Arno. Halle a. S. 24 p. 8°.
MUIR, M. M. P., and CARNEGIE, D. Practical Chemistry. Cambridge, Eng., University Pr. 224 p. 12°. 80 cents.
MUIR, M. M. P., and SLATER, C. Elementary Chemistry. Cambridge, Eng., University Pr. 368 p. 12°. $1.25.
NEW YORK State Survey, the Final Results of the Triangulation, and Eleventh Annual Report of the Commissioners of the. Albany, State. 214 p. 4°.
PENNSYLVANIA, Annual Report of the Geological Survey of, for 1886. Part II. Harrisburg, Geol. Surv. 918 p. 8°.
PRESCOTT, A. B. Organic Analysis. New York, Van Nostrand. 533 p. 8°.
U.S. ARMY, Annual Report of the Chief of Engineers of, 1887. Washington, Government. 369 p. 8°.
VIANNA DE LIMA, A. L'Homme selon le Transformisme. Paris, Baillière. 211 p. 16°.

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SCIENCE

FRIDAY, JANUARY 13, 1888.

WE HAVE THE GREATEST SYMPATHY with those educators who are endeavoring to secure the introduction of science-teaching into the public schools. We would advocate this addition to the present curriculum, not only because of the interest and value of scientific knowledge as such, but because of its value as general information. A great deal of that which is incorporated under the head of elementary science is really general information, and as such should be in the possession of every child in the grammar-schools of the country. We regard the little book entitled 'Introductory Steps in Science,' by the late Paul Bert, as invaluable in this connection, and the English translation should be in every school. Nowhere else are the facts stated as simply, as clearly, and as comprehensively as in this little book. That this subject is beginning to attract the attention which it deserves, is evident. At a recent meeting of the American Society of Naturalists at New Haven it was elaborately and enthusiastically discussed, and now a valuable impetus is to be given to this movement among the teachers themselves by the proposition of the *Academy*, which is one of the best journals of secondary education published in this or any other country, to give a prize of fifty dollars for the best essay on 'Science in Secondary Schools.' The effect of this offer will be to stimulate the teachers of the country to investigate the subject in its practical bearing. It is announced that the committee of awards will give no weight to essays that are merely arguments in favor of science-teaching. This is as it should be, for, unless this condition was made, the majority of the essays would be given over to the threshing of old straw. Contestants are requested to confine themselves simply to the practical exposition of the results arrived at in the schoolroom, and to the best means of obtaining these results. The competition is open to all persons, without regard, as the announcement puts it, "to age, sex, color, or previous condition of servitude," and no paper is to exceed five thousand words in length. All essays must be received at the office of the *Academy*, Syracuse, N.Y., on or before March 15, 1888. We cordially recommend this competition to all persons interested in science-teaching. It gives them an excellent opportunity to be of practical service to the public-school system of the country.

THE MEETING of the Engineers' Club of Philadelphia, Dec. 17, was another instance of the advantage of providing something to eat and smoke at scientific meetings. The secretary, in his report, states that he is glad to be able to announce that both members and guests seem to have been much pleased with their little entertainment. Whereas the usual attendance at the meetings may have varied from a dozen to twenty, the attendance at this meeting amounted to something like three hundred and forty-two. It was not possible to determine exactly. In this case there was no speech-making, or any attempt to introduce any feature which might have deprived the affair of an entirely informal and purely sociable character; but it is believed that the entertainment will be of permanent and substantial benefit to the club. The decline of the old scientific meetings is well illustrated in those held, or attempted to be held, by one of the oldest scientific associations of the country. This association, although it has maintained its existence for more than a hundred years, and has accumulated a library of scientific periodicals and Transactions of societies which is excelled by but one or two in this country, has found it impossible, since the opening of the present season last October, to bring together a sufficient number to form a quorum for the transaction of any business: in other words, no new members have been elected, because fifteen out of the two hundred members of this society had never been sufficiently of one mind to attend its meetings, which are held in a building easily accessible to a very large proportion of them. This society has, as well, tried the social experiment once or twice, and with promising success; but it certainly seems, that, with the differentiation of the interest and work of scientific men, many of the older general scientific societies must develop some new field in which they may be of service. In large degree they are now publication societies, but, as is well known, there is a great disadvantage in the publication in one volume of a vast mass of heterogeneous material. It frequently amounts to a mere burying of the results.

MODERN-LANGUAGE ASSOCIATION.

THE fifth annual convention of the Modern-Language Association was held under the auspices of the University of Pennsylvania on Wednesday, Thursday, and Friday, Dec. 28–30. The large attendance of delegates, chiefly from the East and South, but some also from the West, was gratifying as indicative of the steady growth of the organization. But all who came were amply repaid, for the proceedings were both interesting and instructive. The sessions were opened on Wednesday evening with an address of welcome by Provost Pepper of the university, who was followed by Prof. James MacAllister, superintendent of the public schools of Philadelphia. Professor MacAllister spoke on the place of modern literature in the education of our time. It was a discussion of the topic which at present is engaging the attention of pedagogues all over the world, whether the classics should continue to remain the basis of a liberal education or not. Professor MacAllister ranged himself clearly and openly on the side of those who favored the substitution of modern literatures as such a basis in place of the study of Latin and Greek. After tracing the origin of the system of education which was still in vogue in all parts of the universe fifty years ago, to the revival of classical learning in the days of the Renaissance, he argued, that while it was natural for the men of the fifteenth century to go to the classics for satisfying their sense of beauty and their desire for knowledge, for it was the Latin and Greek authors who had set these aspirations and desires in motion, there is no sufficient reason why we, in our days, should go to the same fountain for quenching our thirst. With the achievements of modern nations in the realms of philosophy, poetry, science, and literature, it is strange that we should continue to train the intellect and to stimulate the heart almost exclusively upon works access to which is possible only after prolonged and laborious study of the languages in which they are treasured up. It is true that much has been done during the past decades towards dethroning the classics from the supreme rulership which they formerly exercised. After a good deal of fighting, science has found a place in our system of education, and it is conceded that any scheme of instruction is incomplete that does not provide for the teaching of modern languages; but the controversy is by no means ended. Professor MacAllister claimed that the modern literatures of the world contained all the elements necessary for attaining the aim of culture, which is to "know ourselves and the world," and that sooner or later they must be given the first place in the intellectual culture of our time, and be made the chief instruments of literary training in the schools.

On Thursday morning, after the transaction of routine business, the reading and discussion of papers began, and continued, with an intermission of one hour at noon, until late in the afternoon. The papers on this and the following day were of two kinds, — some of a technical character, giving the results of detailed investigations of some special subject; and others of a more general character, dealing chiefly with questions affecting the teaching of modern languages. Among the latter was a suggestive treatment of the modern-language seminary system, by Prof. H. S. White of Cornell University.

The purpose of the seminary is to guide the student towards independent investigation; but, in order to do its work properly, the student must first have gone through a preliminary training of no inconsiderable character; and, in the second place, the seminary must be well equipped with the standard editions of the best authors, pamphlets, manuscripts, documents, photographic reproductions of important scenes and monuments, epigraphical material, and the like. In the method of teaching, all study of authors must be based upon a study of the times in which an author wrote.

Professor Kroeh of the Stevens Institute presented a paper on methods of teaching modern languages. After enumerating the various methods which have found followers, and discussing their merits and disadvantages, he pronounced himself in favor of the so-called 'natural method.' The basis of all languages, whether literary or scientific, is the phraseology of every-day life, and this can be learned only by imitation. The 'natural method' proceeds on this principle. But the imperfect training of the ear, or rather the total absence of such training in our schools, causes great difficulties in carrying out this method. The education of young people is still conducted almost exclusively through the eye by means of books. There is so little oral instruction, that the pupils not only do not hear accurately, but have to learn the art of paying attention.

One of the best papers, partaking of this general character, was that by Prof. Albert Smyth of the Philadelphia High School, on American literature in the classroom. "It is certainly discreditable to us that we have done so little towards a faithful and affectionate study of what is purely native and national in our American writings. The text-books, with one or two exceptions, designated for use in schools, show no critical utility and no sense of proportion. This is due to the neglect of the study in the higher classrooms. There are two objects to be reached by a proper attention to this branch: in the first place, it may be highly serviceable in education, because it, more than any other, admits of a complete severance of literature from philology; second, the study would ultimately assist in the development of that literature, and would discipline in it the critical faculty, for it must be admitted that America has not participated in the splendid progress of criticism in Europe during the last twenty years. We are poorest of all in criticism, and when we think of the high service the trained and faithful interpreters of poetry render to a nation, it would be hard for us to overrate the good results that may follow the extension of the English curriculum to include the genesis and brief history of American authorship. It is our precious property to hold the literature of our nation true to the higher ideals of life and its purpose."

There were two papers discussing dialects, by Professor Primer of Charleston, and Sheldon of Harvard University. The former dealt with 'Charleston's provincialisms,' also called 'Charlestonese' by the people in the South: the latter gave specimens of a Canadian French dialect spoken in Maine. In discussing the latter, Professor Elliott of the Johns Hopkins University spoke of the importance of such investigations at the present moment. In a generation or two, all traces of these old dialectical variations, whether in Canada or the South, will probably have disappeared, and, unless they are now accurately noted down from the lips of those speaking these dialects, they will be lost forever to scholars and students of dialectology.

Among the technical papers may be mentioned Professor Collitz's (of Bryn Mawr College) exhaustive essay on the origin of the so-called weak verbs in the Teutonic languages, and Dr. Goebel's review of Paul's 'Principles of *Sprachgeschichte*.' Professor Tolman of Ripon College, Wisconsin, read a paper on the style of Anglo-Saxon poetry. He compares the poetry to "a spirited horse, who takes a few bounds forward, and then stands prancing." Anglo-Saxon poetry is always more than lively, it is intense. Among the peculiarities of Anglo-Saxon poetry, the great scarcity of similes is worthy of note. On the other hand, as a kind of compensation for this defect, we have an abundance of striking poetical synonymes. For instance, the ocean is called such names as 'the whale's home,' 'the fish's bath,' 'the swan's road,' 'the sail road,' 'the course of the flood,s. 'the cup of the waves.' Another striking feature of this poetry is the idealization of the sensual and common. In conclusion, Professor Tolman said that he doubted whether the world has ever seen a purer literature than that covered by Anglo-Saxon poetry.

The proceedings were enlivened by spirited discussions. Before the sessions closed, the convention heard the report of a committee appointed to consider the question of petitioning Congress for a removal of the tariff on foreign books. The committee favored a personal presentation of the subject before the proper Congressional committee, and gave the following as the reasons why the tariff should be removed: —

"The revenue derived from the tax is very inconsiderable, and is wholly unnecessary to the maintenance of government. The theory of protection to domestic industry does not enter into the question. American authors do not desire protection for the reason that books are not merchandise and do not compete with one another. Buyers of books are not governed as ordinary buyers by consideration of price, but by consideration of taste or personal fancy and of special availability for special ends. One book is bought in preference to another, not because it is cheaper, but because it is better. The tax upon foreign books bears heavily upon the class which is least able to meet the financial burden; viz., the professors, teachers, and students. Foreign works, whether in English, French, or German, are absolutely indispensable to these people, and we regard such a tax as is now put upon them as directly harmful to the cause of knowledge and culture of our country. By this book-tariff the 'tools' of our profession are made unnecessarily expensive."

After the election of officers, headed by James Russell Lowell as president, the association adjourned, to meet again during the current year in Cincinnati. The delegates were entertained during their stay by the Historical Association, the Penn Club, and the University of Pennsylvania.

SCARLET-FEVER REPORT.[1] — III.

R. STANSBURY SUTTON, M.D., LL.D., Pittsburgh, Penn., says, "I know to a certainty, that, when I was a general practitioner, I conveyed the disease from a babe who died, to an adult woman who recovered. I recall an instance where the little patient played with the cat. The cat carried the infection to other children in a neighboring house, they having caught and played with it, stroking its fur."

Adolph Koenig, M.D., Pittsburgh, Penn., cites the case of a physician who visited his home during his attendance on a course of medical lectures, some hundreds of miles distant. While at home he came in contact with a younger brother suffering from scarlet-fever. About one week after his return to college he was attacked with scarlatinous sore throat, accompanied with fever, and lasting a number of days. He is decidedly in favor of compulsory reports to be made to boards of health, the State to assume the expense; and the legally qualified physician is the only person capable of making such a report. Laymen would undoubtedly often confound other eruptive fever with scarlet-fever.

J. F. Kennedy, M.D., Des Moines, Io., secretary State Board of Health, reports a fatal case of scarlet-fever in the family of a washerwoman, traced to infected clothing. He regards the disease as communicable from the patient until desquamation has fully taken place, the patient thoroughly bathed, and his person and clothing disinfected. From thirty to thirty-five days would be about the period of danger, dating from the beginning of the attack. A case was reported to the State Board of Health in which scarlet-fever was alleged to have broken out in a family, having been contracted from a dress which had been worn two years previously by a child who at that time died of the fever. Attending physicians should be required to report all the facts connected with each case of the disease that comes under their care, especially the cause and source of infection. Dr. Kennedy says, "I have for several years, in cases of scarlet-fever and diphtheria, used as a prophylactic zinc ferri chlor. and glycerine, equal parts, and giving according to age, to all exposed, from ten to forty drops in water every three or

[1] Continued from *Science* of Jan. 6, 1888.

four hours. I give the iron as a germicide, believing it equally effective in scarlet-fever and diphtheria. I would respectfully refer you to 'Health Exhibition Literature' of the Epidemiological Society of Great Britain, the publications of the American Public Health Association, to reports of State boards of health, to Ziemsen's Encyclopædia on scarlatina, and to articles in the *American Journal of Medical Science*.

Jerome Cochran, M.D., Montgomery, Ala., State health-officer, says, "Our law requires all cases to be reported (1) by the physician in charge; (2) if there is no physician, by the head of the family. We have boards of health in all of our counties, and isolation and disinfection are practised. Isolation and disinfection properly done would go far to prevent its spread. Absolute isolation would, I think, prevent it absolutely."

J. W. Parsons, M.D., Portsmouth, N.H., believes that scarlet-fever has arisen *de novo*, on the ground that after due inquiry no source of infection could be discovered. He thinks that heads of families, as being most interested, should be required to make reports of cases to health boards, and not physicians, who already have enough of such gratuitous work to perform.

George H. Rohé, M.D., professor of dermatology in the College of Physicians and Surgeons, Baltimore, says, "I have never seen any evidence which seemed to me to establish the *de novo* origin of scarlet-fever at the present time. In 1877, I was medical attendant to a poor family, in which there were three children, — a boy of eleven, a girl about eight, and another younger child. The boy contracted scarlet-fever, it was supposed, at school. The other children were both attacked a few days later. Two out of the three died. In this case isolation was impracticable, as the family (of six) lived in two rooms. In 1882 an almost identically similar instance occurred in my practice. A girl of six was taken ill with scarlet-fever, and several days thereafter two younger children, aged four and two respectively, were also attacked within twenty-four hours of each other. The youngest child succumbed to the disease. Isolation was attempted in this instance when the first child was taken sick, but the stupidity of the parents rendered all attempts at prevention nugatory."

Dr. Rohé accepts the general professional opinion that from six to eight weeks should be allowed to pass before the period of danger of infection can be said to be over. He is convinced that thorough and repeated disinfection of the surface of the patient would decidedly reduce the period of infectiveness of the patient, and has so expressed himself in his address on State medicine (see *Journal American Medical Association*, July 2, 1887). He further says, "All cases of scarlet-fever (and all other infectious diseases) should be promptly reported, as soon as the diagnosis is made, to the health authorities. These reports should be made by the attending physician, in order (1) to have a prompt report, (2) to avoid false and malicious accusations, which would be easy if this duty were left to irresponsible persons. Further, a neglect of this duty, if it devolved upon the householder, might cause disastrous results, and afterward give rise to disputes and questions of veracity between the physician and the patient's family. This duty of compulsory notification, if imposed upon physicians, should, however, be made as easy as possible, and should not involve any expense to the practitioner. The question of compensation for such service is one open to debate. No member of the legal profession, whether an official or not, will perform any service for the State without exacting a fee. There is no equitable reason why a physician should be required to act otherwise. Both sickness and death notices furnished to the authorities should be paid for by the latter. It seems to me the duties of boards of health, if notified of the existence of contagious diseases, and when empowered by law, would be to secure the isolation of the patient, disinfection of apartments after recovery or death, private funerals, notification of school-officers if children from the infected house are attending school, supplying disinfectants, and, whenever necessary, invoke the aid of school authorities to close schools. In addition to the public measures mentioned, personal disinfection of the body of the patient, by daily sponging with an effective solution of chlorinated soda or thymol, or inunction with a disinfecting unguent or oil, with immediate disinfection of all discharges and bed-linen, would, I feel sure, result in a marked restriction in the disease. I believe isolation hospitals would aid materially in restricting this disease. Proper instruction of the public (and, I may add, of the medical profession) would be a strong help to practical sanitarians. There are even health officials known to me who might profit from such instruction. I do not think the prophylactic administration of remedies would accomplish much good. Avoiding contact with the infective material is the best and surest means of prevention." For information touching the communication of bovine scarlet-fever to man, Dr. Rohé refers to the reports of Mr. W. H. Power and Dr. E. Klein in the *Practitioner*.

T. B. Heimstreet, M.D., Troy, N.Y., thinks that cases of scarlet-fever should be reported to health boards by medical attendants, and that these boards should prevent the attendance at school of other children of the same family in which the disease exists, and should disinfect the apartments, etc.

George Glenn Wood, M.D., Muncy, Penn., writes, "My plan of preventing the spread of scarlet-fever would be to establish one or more scarlet-fever hospitals, according to size of city, on the same plan that small-pox is managed. Inasmuch as the large cities are the usual hot-beds for this, as all infectious diseases, and its suppression there would mean the escape of rural cities and towns, the proper management would be to stamp it out at the former places. If, then, scarlet-fever patients were instantly removed, and quarantined in such special hospitals, there attended by the family physician if desired, and nursed by parent, friends, or professional nurse, advantages would occur not only to patient, but to other members of same family, and the public at large. Of course, to be effectual, the whole matter must be compulsory."

Lincoln R. Stone, M.D., Newton, Mass., says, "I can hardly say that cases can arise *de novo*, but a few years ago, in July, in a farmhouse during haying, a case occurred where no case had been known for years. There had been no intercourse with other people, no other case known in town. The house was situated on top of a high hill, half a mile from any family. The patient was a young child about three years old. There was no other case in the house, though young children in the family. Most careful inquiry could throw no light on the case: it seemed almost *de novo*." He reports a case where a blanket, used by a child before and during an attack of scarlet-fever, by some accident or carelessness, was not cleansed or destroyed after recovery, and a child, a relative, visiting, played with the blanket and had a severe attack.

D. W. Hand, M.D., St. Paul, Minn., member of the State Board of Health, thinks that placards should be placed on the houses where scarlet-fever exists, so as to give the public notice of the infection. He knows of several instances where strict isolation and disinfection have confined the disease to one child in a family.

A. J. Howe, M.D., Cincinnati, O., in reference to the *de novo* origin of scarlet-fever, says, "I do so believe, but may be mistaken. My belief is based on the fact that typhus, erysipelas, and diphtheria do arise *de novo*, under influences which develop zymotic poison. Possibly scarlet-fever virus is too strictly specific to come from any thing but the scarlatina germ." Dr. Howe relates the following incident: "A gentleman of my acquaintance, living in the country, brought a child, a boy five years old, from a city fifty miles distant. On the way, when near home, he stopped at a schoolhouse a few minutes during recess, and several of the pupils gathered around the little stranger. The next morning I was professionally called to the child, and found him violently sick with scarlet-fever. In eight days from that time, thirteen out of twenty-seven of the school-children were down with scarlet-fever. There had not been a scarlatina case within five miles for three years." He recalls another instance in which a wadded hood, that of a child which died of scarlet-fever, was the bearer of the disease to a child in the country, to whom the garment was given. In this case the article retained the infective virus two months, — March and April.

J. Howard Morgan, M.D., Westerly, R.I., reports, "I have now under care eleven cases in one family, who are convalescing from scarlet-fever of rather mild type, the first three of which (viz., the youngest three of the family) began to sicken seven days after the coming of their grandmother to visit the family, from a place some six miles away, where she had been attending for a week or two another grandchild who had 'sore throat and the same sort of rash,' but was not sick enough to necessitate calling a physician. The grandmother wore nearly the same clothing while on her visit that she had when attending this previous case. The other eight cases of the eleven probably took the disease from the first three, since, owing to the size of family and their circumstances, satisfactory isolation could not be had; and I know of no other cases in the vicinity."

Dr. Morgan recommends to disinfect discharges from bowels, bladder, and throat by adding an equal volume of solution of corrosive sublimate (1 to 500); to anoint the skin daily during desquamation stage, so as to diminish the risk from fine scales of epidermis floating in the air; to bathe frequently the skin during that stage, and to disinfect the water so used by adding an equal volume of the corrosive-sublimate solution; to disinfect bedding, clothing, etc., by soaking in a solution of corrosive sublimate (1 to 1,000) or by prolonged boiling in water; to disinfect rooms, etc., by burning dust and sweepings, washing wood-work, etc., with corrosive-sublimate solution (.1 to 1,000), and by thorough fumigation with sulphur-fumes finally; to forbid nurses or members of the family attending the sick to mingle with others without first disinfecting their hands, etc., and changing their garments worn in contact with the sick; lastly, to forbid public funerals for those dying of scarlet-fever. He further says, "Where I have succeeded in having these measures carried out, I have never known the disease to spread further. Beyond thorough ventilation of apartments, and disinfection as above recommended, only such measures as are calculated to promote health and bodily vigor will be of any service to prevent the well from contracting the disease when exposed to it. The use of belladonna, camphor, etc., as preventives, I believe to be utterly valueless, except, perchance, for the *mental* effect upon those having exaggerated fears of the disease. Aside from the cases usually cited in text-books, a case of interest was reported in the London *Lancet* of April 11, 1868, I believe. A domestic servant died of scarlet-fever of very malignant type, after which the doctor gave directions for the most vigilant care in purifying the room and its contents, bedding, clothing, etc.; all which directions were strictly carried out, except with regard to the blankets, which, as the young and newly married mistress objected to the conversion of new blankets into old ones by the process of scouring, were put away uncleansed in a wardrobe in a vacant room. 'Fourteen months afterwards, this young housekeeper, expecting her first confinement, whilst providing a temporary bed in her room for the accommodation of her monthly nurse, took these identical blankets from their resting-place as a part of the covering for it. About a fortnight after making this provision, her labor not having come on in the interval, I was requested to visit her. I found her under scarlet-fever of the most severe form. In four days parturition commenced, and she died from exhaustion in half an hour after the birth of her child.'"

James P. Marsh, M.D., Green Island, N.Y., gives the following from his case-book: "Feb. 3, 1887, Miss M., aged eighteen, came down with scarlatina, which ran a moderately severe course. On Feb. 11, 1887, her nephew, aged five years, came down with the disease, which ran a mild course. Through the whole of his aunt's illness, he was constantly in the room with her, from certain circumstances isolation being impossible. At no time after the beginning of her illness was he out of doors, hence there was no other source of exposure." Dr. Marsh refers to the following articles: 'Practical Considerations Regarding the Acute Infectious Fevers, especially Scarlet-Fever' (*Gaillard's Monthly*, vol. xi. p. 427), 'The Source of Infection and Limits as to the Time of Infection of Scarlet-Fever and Measles' (*New York Medical Record*, vol. xxvii. p. 612), 'Duration of Contagiousness after Scarlet-Fever' (*Transactions of the New York State Medical Association*, vol. i. p. 73), 'Duration of the Infectious Period of Scarlatina' (*New York Medical Journal*, vol. xiv. p. 278).

A. Vanderveer, M.D., Albany, N.Y., reports that healthy children carried in a carriage that had the day before contained cases of scarlet-fever, sickened with the disease in due time.

Winslow Anderson, M.D., San Francisco, Cal., writes that on several occasions, when his patients have been visited while suffering with scarlet-fever, the visitors have carried the disease several miles, and communicated it to children.

Thomas F. Wood, M.D., Wilmington, Del., says, "My children played in a room where some clothing was being quarantined because of a suspicious eruptive disease which was too light to be called scarlet-fever. The boy who came first in contact with the clothes was seized, and two others took it from him."

A. R. Hopkins, M.D., Buffalo, N.Y., relates an instance in which a child, ill with the disease, sent a book from its bed to a neighbor's, the only direct communication between the houses or families. The disease followed the book in five days. In another instance a stuffed chair from a nursery where the disease had been present six months before, was sent by express to a house miles away, where no fever was, or had been, in years. The disease followed the chair in less than two weeks.

Samuel B. Ward, M.D., Albany, N.Y., says, "Many cases have occurred in my practice where one child in a family would catch the disease from some known exposure, outside the house, and within a week other children in the house would take it from the one first affected. N. W., aged eight, was taken with the fever. Three or four days later, A. W., her sister, aged six, took it, the two having slept together before the first was taken ill. The baby, aged two years, was promptly isolated, and escaped for six weeks. Through the carelessness of a nurse he then one day ran down stairs — or rather crept down — into his sick sister's room, came down three days afterwards with the disease, and died of it. E. K. aged five, and L. K. aged three, were attacked at nearly the same time with scarlet-fever. The baby, aged eighteen months, was spending the day with a friend when the discovery was made, and did not return home for two months. In the mean time the other two children recovered. The utmost care was taken with the disinfection of the house by burning large quantities of sulphur with all openings closed, scrubbing the wood-work and floors with bichloride of mercury, leaving all windows open for twenty-four hours after fumigation, washing all bedding and clothing in carbolic acid, etc. After the house was thoroughly warmed again, — it was in winter, — the baby was brought home, took sick with the fever within a week, and died of it. Could the wall-paper have retained the contagion? It was thoroughly swept down, but not removed."

Dr. Ward encloses to us a letter which he has received, and which sufficiently explains itself: "The case you refer to, in your note to me, was that of my daughter, who, in the summer of 1874, after a sojourn of seven weeks at the cottage occupied by my family, and while still there, broke out with scarlet-fever. She had not been away from the place from her arrival there up to the time she was attacked. There was no other case of scarlet-fever at the hotel, or in the cottages connected with it, during that summer. It seems that the family — friends of ours — occupying the cottage contiguous to the one occupied by my family, had, during the winter and spring months just preceding, suffered severely with *scarlatina maligna*, losing one child from among those attacked. In the month of August, about the middle of the month, it is usual to experience at this place a cold storm, generally of three days' duration, when heavy winter clothes are necessary to comfort. Our friends in the cottage contiguous, being habitués of the place, like ourselves, were well provided in this respect, and, during the prevalence of the storm of that year, clad themselves and their children in their winter garments. Dr. Budd, professor in the Medical School of the University of New York City, now deceased, who attended my daughter, had no doubt that my daughter contracted the disease from absorbing the germs quiescent in the woollen winter garments of the children of our friends, with whom my daughter was a constant playmate. The disease in her case, however, though well defined and the eruption profuse, proved a light one, I being able to bring her home on the eleventh day from the first appearance of the disease, without any unfavorable resulting consequences. During the continuance of the illness, every window in my cottage was kept open, save those in my daughter's room, both night and day; the door of her room remaining likewise open, thus admitting freely the sea-wind, whether violent or mild. At one period of her illness there was an incursion of mosquitoes, continuing for several days, so dense that lamps were not lit, and guests moved around or sat about with handkerchiefs upon their heads; the curious fact of which circumstance, however, was the fact that though every room in my cottage was thick with mosquitoes, excepting that of my daughter, there were only two of these insects at any time observed in her room during the whole period of her illness."

W. W. Johnston, M.D., Washington, D.C., says, "In my own family one case of scarlet-fever occurred: other children escaped. In another family of eight children, isolation and disinfection prevented the spread of the disease, but such instances are numerous."

Charles W. Covernton, M.D., Toronto, Can., ex-president Provincial Board of Health, and Peter H. Bryce, M.D., Toronto, Can., secretary of the Provincial Board of Health, relate an instance where each succeeding member of the family took it at intervals of three or four days. At the period when desquamation of the first was beginning, a younger took a mild form of the disease. A few days afterwards conjunctivitis of both eyes appeared, ending rapidly in the destruction of sight. The disease afterward extended to the middle, with perforation, of tympanum, etc. Thereafter the disease attacked the knee and elbow joints, with intense suppuration and inflammation, ending in their destruction. The child died on the twelfth day. There were some four or five children in all. In the family of one of these physicians, a Cambridge student had a book which he was studying at the time of the seizure with scarlatina. After his death, said book, with others that had been open in the sick-chamber, were packed up and sent to the latter's family in London, where they were placed in a garret. Ten years after, a younger brother at Cambridge sent for these works. Shortly after receiving them, he took scarlatina and died. No other exposure to the disease was known.

Dr. Bryce, in speaking of the methods to be adopted in preventing the spread of the fever, refers to an experience he had five years ago, in the following language: "A child in a family in which there were five children was taken with scarlet-fever. It and its mother were put in an upper room, and the lobby cut off by a curtain antisepticized with a solution of corrosive sublimate. The soiled articles of clothing, etc., were placed in the same solution, and the remnants of food were burned in the fireplace of the room. Seclusion was perfect. At conclusion of desquamation every thing was disinfected. No second case occurred in the family. Dr. Bryce thinks the period of infection is not less than forty days.

EXPLORATION AND TRAVEL.

TRANSVAAL. — The railroad from Delagoa Bay to Transvaal, which was mentioned in *Science*, No. 245, has been opened from Lorenço Marques to the boundary of the Portuguese Possessions. It is somewhat difficult to form a correct idea of the state of affairs in that region, as all news comes from English journals, and as the English are in constant fear of an increase of Boer, German, or Portuguese influence in South Africa. The Boers, of course, make strenuous efforts to open a route to the sea independent of the English, who threaten to swallow up the republics. This aim has been achieved by the new railroad, the greater part of which runs through Transvaal, and is in the hands of the Boers, while the part now opened is in the hands of American capitalists. The opening of this railroad, which was represented by English travellers as improbable, will result in a rapid development of the natural resources of the Transvaal. Although a strong influx of Englishmen into those countries may be expected, it is not probable that they will swamp the Boer element, which has so long resisted the incessant attacks of the English.

ZANZIBAR. — The Sultan of Zanzibar, whose territories have been reduced to a narrow strip of coast-line by recent treaties, has leased his rights on the African coast between Wanga, at the mouth of the Umba, and Vitu, to the British East African Association. As he has made a similar contract with the German East African Association, his rule is practically limited to the islands of Zanzibar and Pemba and several parts of the coast that are of little importance. The part of the coast leased to the British Association includes the whole coast-line between the line of demarcation between German and British influence and the German district of Vitu. It is said that vigorous attempts will be made to open a route from the coast to the Victoria Nyanza.

FARINI AND CHAVANNE. — Dr. Hans Schinz, who made a long and interesting journey in South Africa, undertakes to expose Farini, who claimed to have accomplished a long and hazardous journey to Lake Ngami. He gives convincing proof that Farini, who wrote a large volume on his adventures, never entered the Kalahari, and never came into those remote regions in which he claims to have made important explorations. Several passages in his book had excited the suspicion of scientists; and Schinz gives now, in two letters to *Petermann's Mitteilungen*, conclusive proof that his adventures and discoveries are one great fraud. The work of another African traveller, J. Chavanne, has been justly and severely criticised. Chavanne travelled for some time on the Kongo, and published the results of his observations in a magnificent volume, which is now shown to be largely an audacious plagiarism on other publications on the Kongo, particularly Pechuel-Loesche's important work. Part of Chavanne's own observations are shown to be untrustworthy. Dr. von Danckelmann, who criticised Chavanne, and Schinz, must be congratulated for their courage in exposing these scientific impostors. Nothing should be more rigidly demanded from travellers than truth and a strict distinction between their own observations and those of others. Those infringing these rules cannot be too severely criticised.

THE OBANGI. — Captain van Gèle, who attempted to reach the Welle from the falls of the Itimbiri last summer, but gave up his plan on account of the difficulty of obtaining food at that point, left Leopoldville on Oct. 2 on board the 'En Avant.' He proposed to ascend the Obangi, and thus to ascertain its connection with the Welle. It will be remembered that Grenfell succeeded in ascending the rapids of Zongo, which prevented Van Gèle from exploring the upper part of the river. After having passed these rapids, Van Gèle hopes to find navigable water and to reach the Welle. As it is doubtful whether the Obangi receives a large tributary from the east which may be identical with the Welle, he will carefully examine the left bank of the river, and explore important tributaries which he may discover (*Mouv. géogr.*).

MENTAL SCIENCE.

Re-Action Time for Sensations of Temperature.

IN a recent number of *Pflüger's Archiv* of physiology, Vintschgau and Steinach give a preliminary report of a series of experiments upon the time necessary to perceive a sensation of heat, of cold, or of contact with the skin in various parts of the body. The time necessary for the mere feeling of contact on the middle of the forehead was for Vintschgau .119, and for Steinach .107, of a second. The time of feeling a contact upon the right cheek was .119 and .101 of a second respectively; and similar numbers for the volar and dorsal surface of the left hand are .126, .128, and .133 and .111 of a second. The results of their experiments upon the time it takes to perceive a sensation of cold and of warmth are given in the table below:—

	COLD.		HEAT.	
	Vintschgau. (2.2°-4.8° C.)	Steinach. (2°-2.8° C.)	Vintschgau. (48°-49° C.)	Steinach. (45°-49° C.)
Right temple	.160	.116	.166	.132
Left temple	.170	.124	.185	.138
Middle of forehead	.143	.116	.144	.128
Right cheek	.143	.114	.154	.117
Left cheek	.151	.116	.158	.146
Volar surface of hand.				
At middle joint of finger	.186	.152	.205	.173
Near the ulna	.206	.186	.208	.206
On ball of thumb	.185	.194	.251	.175
Dorsal surface of hand				
Near the ulnar side	.208	.179	.246	.199
Near radial side	.204	.170	.233	.196

The conclusions that these tables enable us to draw are, that we feel a sensation of cold more quickly than one of heat, though the difference is slight; again, that we re-act more quickly to sensations of contact than to those of temperature. If the stimulation be applied to the same spot repeatedly and at short intervals, the time is in general lengthened. This was found to be true for the forehead and cheek, for sensations of cold, after a very few minutes. The same is true for the forehead with the stimulation by heat; but on the cheek after fifteen minutes, with the time taken each minute, there was no such lengthening of the time. More details regarding the method of obtaining these results will be given in a future paper.

The same topic has also been investigated by Dr. Goldscheider (*Archiv für Anat. und Phys.*, 1887, v.). His method was to approach a metal ball to the skin, thus breaking an electric connection and re-acting by a simple movement of the jaw. To get reliable results, he chose parts with a thin epidermis, and used an intense stimulus. For cold, the ball was at a temperature of 15° C.; and for warmth, at a temperature of 50°C. In all, over two thousand observations were made. The average of all these times was, for cold, on the face, near edge of the eyelid, .135, on upper arm .150, on the abdominal surface .226, and on the inner surface of the thigh .255, of a second. Corresponding times for the perception of warmth on the four places were .190, .270, .620, and .790 of a second. Warmth is thus much more slowly perceived than cold, and the more so the farther from the brain the part of the body tested, the difference amounting in the lower limbs to nearly half a second. It should be said that care was taken to choose parts of equal sensibility in the several regions of the body. If the stimulation is only moderately strong, and especially if the stimulation is weak, the re-action time is much lengthened. For example: a moderately warm stimulus on the arm takes .46 to .54 of a second to be re-acted upon, and, if the stimulus is weak, it takes .90 of a second to 1.1 seconds. That this lengthening of the time is really an effect of the intensity of the stimulus, is shown by the fact that it occurs in weak stimulation of the most sensitive areas, and not only in strong stimulation of insensitive areas, as would be the case were the lengthening due to the slow radiation through the epidermis. These facts are all in good accord with former investigations of the topic. The explanation of this difference between the re-action time for heat and for cold cannot yet be given. But Dr. Goldscheider is not ready to ascribe it to the fact that the one sensation passes up the white columns of the cord and the other through the gray matter. The results of the two investigations agree fairly well on the time for the perception of cold, but the latter gives much higher values for the re-action time to a warm stimulus.

VISUAL UNITS IN THE RETINA. — In viewing a series of uniformly scattered dots, we will at a certain distance be able to recognize them as dots; but if the object be further removed, they will fuse into a more or less uniform surface. By testing back and forth, one can quite accurately determine the distance from the eye at which the dots are just visible as single dots, and, if we measure the distance between the dots, it is possible to calculate how large a surface on the retina is necessary to impress us with the vision of a separate dot. Such a surface would be a visual unit, and the point of importance is to find what anatomical basis there is for this physiological unit. In 1881 Carl Du Bois-Reymond measured the size of these visual units in the fovea, or yellow spot of the retina, and found that such a unit was exactly the size of a cone at this point. He did not use dots, but rays of light shining through holes in a screen. This makes it extremely probable that a cone is the anatomical unit of vision. Dr. Wertheim (*Graefe's Archiv*, 1887) has continued these determinations for the lateral parts of the retina, where the vision is less fine, and where it is in general known that the number of cones is fewer. In tracing the decrease in the number of visual units to a certain area as we go upwards from the centre of the fovea, he gets a curve, showing at first a marked decrease, then a short period of almost no change, and then a long period of slow, regular decrease. If we ask, How does this harmonize with the anatomy? the answer cannot be as definite as we would wish. The part of the curve showing a marked decrease corresponds to the outer parts of the yellow spot; and the ratio between the number of visual units at the edge of this, compared to the number in an equal surface of the centre, is as one to two or three, while the ratio of the number of the cones in the two places is about as one to three or four. The next period of the curve cannot be thus compared, because the size of the yellow spot is differently determined by different observers. With regard to the lateral portions of the retina, it can be said that the largeness of the visual units makes it necessary that the cones be separated, and this the anatomy bears out. The general conclusion is, then, that the cones are very probably the anatomical basis for the visual units, and that the rods (that become more numerous as we recede from the centre of the fovea) cannot convey the sensation of a single objective point.

THE PSYCHOLOGY OF JOKING. — Dr. Hughlings-Jackson publishes some interesting remarks on this topic in the *Lancet* of Oct. 27. He regards punning as the lowest stage of the evolution of humor, but even in the pun he sees a material for the study of normal mentation. In a pun we have two ideas called to the mind at once, — a double vision, as it were; and, as all thought is the comparison of relations, this is simply a caricature of the normal process of thought. Again: the world owes a great debt to the first punster, because he began the 'play' of the mind (in the same sense as art is founded on the play-instinct), and so detached himself from the grossly useful, and showed a surplus energy capable of developing into the highest traits of mankind. To lack a sense of humor is a bad thing. "The man who has no sense of humor, who takes things to be literally as distinct as they superficially appear, does not see fundamental similarities in the midst of great superficial differences, overlooks the transitions between great contrasts. I do not mean *because* he has no sense of humor, but because he has not the surplus intellect which sense of humor implies." Again: "I think that observation confirms what *a priori* seems likely, — that *pari passu* with the evolution of the sentiment of jocosity (playing at unreality) is the evolution of power of realistic scientific conception, — from sense of the merely ridiculous with parallel realistic conception of simple things, up to sense of humor with parallel realistic conception of complex things." Dr. Jackson then looks upon punning as a 'mental diplopia' in which there is a double mental vision, but not of the kind conducive to useful ends. It is something like the thought in dreams. He sums up his view in these words: "The process of all thought is double, in degrees from a stereoscopic unity of subject and object to manifest diplopia (two objective states in one subject). The process of all thought is tracing relations of resemblance and difference, from simplest perception — to say what a thing is, is to say what it is like and unlike — up to most complex abstract reasoning. The formula of the caricature of the normal process of thought is the 'pretence' of some resemblance between things vastly different, from punning, where the pretended resemblances and real differences are of a simple order, up to humor, where both are highly compound. We have the 'play' of mind in three degrees of evolution, three stages of increasingly complex incongruousnesses."

BOOK-REVIEWS.

Geology and Mining Industry of Leadville, Colorado. With Atlas. By SAMUEL FRANKLIN EMMONS. (U.S. Geol. Surv., Monograph XII.) Washington, Government. 4°.

THE magnificent volume in which the geology of the Mosquito Range, and more particularly that of the environment of Leadville, Col., and its mining industry, is described, contains the results of investigations begun in 1879, at the instance of Clarence King, first director of the United States Geological Survey, and continued until May, 1881. Abstracts of the results of these investigations have been published in the 'Second Annual Report of the Director of the Survey,' but it is only now that the full work and the magnificent atlas have been issued. We will cull only a few points from this great work which are of general interest. The first part of the book deals with geology. A brief history of the discovery and growth of the Leadville region is given. Emmons demonstrates that the paleozoic and mesozoic strata lie unconformably on the Archæan, and, what is of the greatest importance, that the formation which is immediately adjacent to the Archæan varies from

SCIENCE.—SUPPLEMENT.

FRIDAY, JANUARY 13, 1888.

ADDRESS OF MAJOR POWELL IN MEMORY OF PROFESSOR BAIRD.[1]

BAIRD was one of the learned men of the world, and, to a degree perhaps unexampled in history, he was the discoverer of the knowledge he possessed. He knew the birds of the air, from the ptarmigan that lives among everlasting snows, to the humming-bird that revels among the orchids of the tropics; he knew the beasts of the forests and the prairies, and the reptiles that crawl through desert sands or slimy marshes; he knew the fishes that scale mountain-torrents, that bask in quiet lakes, or that journey from zone to zone through the deep waters of the sea. In all this realm of nature he had a minute and comprehensive knowledge that no other man has ever acquired. What others have recorded in this field of research he knew, and to their discoveries he made a contribution of his own so bounteous, so stupendous, that he is recognized as the master of systematic zoölogists.

All of Baird's scientific work is an illustration of modern inductive or scientific reasoning. The inductions or general principles of modern science are reached by the accumulation of vast stores of facts. He knew how to accumulate facts; how to reject the trivial and select the significant. Modern science is almost buried under the *débris* of observation, the record of facts without meaning, — the sands of fact that are ground from the rock of truth by the attrition of mind; but Baird could walk over the sands and see the diamonds. Then he knew how to marshal significant facts into systems, and to weld them into fundamental principles. In all his works there can be discovered no taint of *a priori* reasoning or syllogistic logic; for in his mind there was no room for controversy, and disputation fled before the light of his genius. Formal logic, a disease of modern thought, — the contagion of Aristotlina, — never ravaged his brain. With healthful directness, he sought the truth guided by wise inference, and told the truth in its simplicity.

Baird was an organizer of the agencies of research. When a bold explorer essayed to penetrate the seas of ice by the path of peril and in quest of fame, he would ever so manage that a corps of quiet scholars should be attached to the expedition to study the climate of the Arctic zone, the geology of the Arctic rocks, the flora of the Arctic lands, or the fauna of the Arctic fields; and the best knowledge we have of the igloo-dwellers, the Eskimo whose home is on the ice of the north, has been brought to us by the quiet students he succeeded in attaching to Arctic exploring expeditions; and so the love of glory was made to serve the cause of truth.

When, in the interests of international commerce, expeditions were sent to explore and survey routes of travel and transportation across Central America from sea to sea, he managed to send with them corps of scientific men whose function it was to bring from the tropics all forms of its abundant life, vegetal and animal, and the relics of the arts of the people of Central America as they are exhibited in stone and clay and gold; and the National Museum has been enriched by the results of this labor, and the boundaries of human knowledge extended thereby; and so the greed of gain was made to serve the love of truth.

When our army was distributed on the frontiers of the land, he everywhere enlisted our scholarly officers into the service of science, and he transformed the military post into a station of research, an Indian campaign into a scientific expedition. Scott, Marcy, McClellan, Thomas, and many other of the great generals of America, were in their younger days students of natural history, and collectors for Baird. When our navy cruised around our shores, its officers were inspired with that love of nature which made every voyage of military duty a voyage of discovery in the realms of natural science; when they journeyed among the islands of the sea, they brought back stores of scientific materials; and when they sailed through the littoral waters of other continents, they made voyages of scientific investigation. Many of these earlier naturalists of the navy in subsequent times became commodores and admirals.

[1] Delivered Jan. 11, before a joint meeting of the Philosophical, Biological, and Anthropological Societies of Washington.

But time would fail me to tell of the exploring expeditions and the railroad surveys throughout America, and the travels throughout the world, which he utilized in the interest of science, or of which he was the immediate projector. Of the abundant material thus gathered from all parts of the world, some has gone to enrich American institutions of learning, and some has been gathered into the National Museum, — the result of Baird's organizing genius and a splendid monument to his memory.

The hills of the land stretch not so far as the billows of the sea; the heights of the mountains are not so great as the depths of the ocean; and so the world was unknown until this greater region was explored. The treasures of the land did not satisfy the desires of Baird, he must also have the treasures of the sea; and so he organized a fish commission, with its great laboratories and vessels of research.

> "What hidst thou in thy treasure-caves and cells,
> Thou hollow-sounding and mysterious main?
> Pale, glistening pearls and rainbow-colored shells,
> Bright things which gleam unreck'd of, and in vain.
> Keep, keep thy riches, melancholy sea!
> We ask not such from thee."

What the scholar asked of the sea was all its forms of life, its organisms minute and lowly, its crawling articulates, its pearl-housed mollusks, its fishes that swim in armies, and its leviathans that prowl among the waves, — the life of the reedy shore, the life of the ocean-current, and the life of the deep sea. So, with many ingenious appliances, he and his lieutenants sailed away to explore the ocean's mystery. So the Fish Commission was an agency of research; but it was more: he made it an agency by which science is applied to the relief of the wants of mankind; by which a cheap, nutritious, healthful, and luxurious food is to be given to the millions of men. He affirmed that for the production of food an acre of water was more than equal to ten acres of land, thus giving to the gloomy doctrine of Malthus its ultimate refutation, and clearing away the veil of despair from the horizon of the poor; for, when the sea shall serve man with all the food that can be gathered from its broad expanse, the land will not contain the millions whom it is thus possible to supply.

In the research thus organized the materials for the work of other scientific men were gathered. When a great genius reads to the world a chapter from the book of nature, the story is so beautiful that many are stimulated to search in the same field for new chapters of the same story. Thus it was that the publication of Baird's great works on natural history developed in America a great corps of naturalists, many of whom have become illustrious; and the stimulus of his work was felt throughout Europe. In the research which he organized the materials were furnished for this corps of naturalists; but his agency in the development of this body of workers was even more direct. He incited the men personally to undertake and continuously prosecute their investigations. He enlisted the men himself, he trained them himself, he himself furnished them with the materials and instruments of research, and, best of all, was their guide and great exemplar. Thus it was that the three institutions over which he presided, the Smithsonian Institution, the National Museum, and the Fish Commission, were woven into one great organization, — a university of instruction in the methods of scientific research, including in its scope the entire field of biology and anthropology. Such is Baird the investigator, Baird the organizer, and Baird the instructor, in the length, breadth, and thickness of his genius, the solidarity of a great man.

All that I have said is a part of the public record; it is found in the great libraries of the world. But, however exalted the feeling of admiration we may entertain for Baird as an eminent scientific man, it is to his attributes as a man as disclosed in his personal relations with friends, associates, and contemporary men of affairs, that we most fondly turn, since it is in these relations that he most clearly exhibited those kindly and modest traits of character which made him so universally beloved.

As a man of affairs, Professor Baird exhibited great sagacity. His plans for the organization of scientific work were of great magnitude; and had they been presented to the administrative officers of the government or to legislative bodies with exaggeration, or even had they been presented with the glow of an enthusiastic missionary of science, they might well have encountered opposition. But Baird had a wonderful faculty of presenting his plans with extreme modesty, and with a degree of under-statement but suggestive explanation of possibilities which speedily caused him to whom the appeal was made himself to become an advocate of the professor's measure. He had traits of character in this respect which are hard to explain, and which seem at first to be contradictory. In the advocacy of measures his modesty amounted almost to timidity, and he avoided alike argumentation and notoriety, and he presented his measures with the directness of a child.

Notwithstanding all this, there was such a poise of faculties, such dignity of mien, that he impressed those with whom he came in contact as a venerable and wise patriarch. He seemed devoid of personal interest or feeling, and solicitous only for the welfare of those to whom he was in fact appealing, and he conveyed the impression that he was giving benignant advice. Thus the shrinking, sensitive man, who could not even stand before a public body, such as a committee of Congress or a scientific society, and advocate a cause, could, from his seat by the fireside or at the desk, so illumine the subject with which he had to deal that men stood round him to gather his words, that nothing should be lost; for in the exposition of his subject he illumined ever thing with clear statement, arising from an exhaustive knowledge and full understanding of results.

As the director of the work of research in which other men were engaged, Professor Baird had marvellous insight and skill. The appliances of modern research, alike in the inorganic world and in biology, have come to be multifarious and diverse; and there is this peculiarity about their use: that once used, so that the secret of nature which they were planned to unlock has been revealed, they speedily become obsolete, and immediately new keys, new apparatus, new devices, are necessary. Thus to a very large extent skill in research is absorbed in the skill necessary for the development of the agencies of research. A continuous line of research, prosecuted by a corps of men so that the boundaries of knowledge are carried far forward, can result only from a continuous line of inventions in the apparatus of research; and it was here that Baird exhibited his skill. His own devices were many and constant, and even he was fertile in suggestions to his assistants. No wonder, then, that so many of the secrets of nature were unlocked through his agency. It was in the direction of this work of research that the man Baird stood forth as a giant; it was where his vast knowledge of details was most apparent; it was where his marvellous skill was most shown; it was where his insight into human character was most exhibited. With clearness he formulated his interrogatories; with aptness he selected his course of procedure; with judgment he sought the aid of others, and with suggestiveness directed their work. And, lo! his questions were speedily answered. It was in this manner that his own good hands were supplemented by the hands of many, that his own great mind was re-enforced by the best mental activity of many assistants; and thus the whole body of men under his control worked together as one organic integer for the increase and diffusion of knowledge among men.

In his work with his assistants he scrupulously provided that every one should receive the meed of honor due for successful research, and treated all with generosity. Many an investigation begun by himself was turned over to assistants when he found that valuable conclusions could be reached; and these assistants, who were his warm friends, his younger brothers, reaped the reward; and he had more joy over every young man's success than over the triumphs and honors heaped upon himself from every quarter of the globe. He was the sympathetic counsellor of many men; into his ears were poured the sorrows and joys of others, and he mourned with the mourning and rejoiced with the rejoicing. To those in need his hand was ready and his purse was open, and many and many were the poor who called him 'blessed.' Though a man of great force of character, a man of great learning, a man upon whom had been showered the honors of the scientific world, in character he was as simple as a child. He had a fund of 'folk-lore,' and loved the books and papers written for children. In his later years, weakened with disease and burdened with many labors, he still read *St. Nicholas* from month to month, and kept the run of every little story, and was glad to be 'a child again.' His life at home was pure and sweet, and full of joys, for he gave and received love and trust and tender care. But the history of his home life is sacred. Its words and acts abide in the hearts of the husband, the wife, and the daughter.

For many long months he contemplated the day of parting. Labor that knew no rest, responsibility that was never lifted from his shoulders, too soon brought his life to an end. In the summer of the past year he returned to his work by the seaside, that he might die in its midst. There at Wood's Holl he had created the greatest biologic laboratory of the world; and in that laboratory, with the best results of his life-work all about him, he calmly and philosophically waited for the time of times. Three days before he died he asked to be placed in a chair provided with wheels. On this he was moved around the pier, past the vessels which he had built for research, and through the laboratory, where many men were at work at their biologic investigations. For every one he had a word of good cheer, though he knew it was the last. At the same time, along the pier and through the laboratory, an invalid child was wheeled. "We are rivals," he said, "but I think that I am the biggest baby." Then he was carried to his chamber, where he soon became insensible, and remained so until he was no more.

"Blessed are the pure in heart, for they shall see God."

place to place. At one point triassic beds, sloping away at varying angles from the flanks of the mountain, rest directly upon the Archæan beds; at another point, the lower beds of the cretaceous; at still another, and this more rarely, the carboniferous limestones are exposed, resting against the Archæan; while above them, always conformable, are found the triassic, Jurassic, and cretaceous formations, as one follows the section in an ascending geological sense. These facts make it evident that these beds have not been folded into a long anticlinal fold, the crest of which was subsequently planed off by erosion, but that the exposed Archæan parts represent an ancient continent or island along whose shores the younger beds were deposited. The lithological character of the series confirms this view, as they bear internal evidence of being a shore deposit. The Colorado Range is the most extensive of these ancient land-masses. Originally the western boundary of the Park area consisted of two or more masses, forming a general line of elevation parallel to the Colorado Range. Through the south-eastern portion of this area, and parallel with its longer axis, runs the valley of the Upper Arkansas River, which, however, during paleozoic and mesozoic times, did not exist.

The Mosquito Range was not formed until the great dynamic movement in the Rocky Mountain region at the close of the cretaceous. Enormous masses of eruptive rocks are found in this region crossing the sedimentary strata to greater or less elevations, and then spreading out in immense sheets along the planes of division between the different strata. From the fact that these interbedded sheets of eruptive rocks are found practically conformable with their bounding strata, and, like them, folded into sharp folds and cut off by faults, Emmons concludes that the eruptive activity preceded the uplift of the Mosquito Range. The latter was effected by a pushing-together from the east and from the west, a secondary movement acting in a north-and-south direction. The Archæan masses, between which the conformable series was deposited, the resistance of which caused the crumpling of the beds, must have participated in the folding.

A special chapter is devoted to the discussion of the geological phenomena and theoretical questions. The most important of these are the discussion on the folds and faults, and a comparison of the monoclinal folds and the great faults of the Great Basin with those of the Rocky Mountains. Emmons believes that the former are folds similar to those of the eastern mountainous region. He considers them true plications, and believes, that, could the structure beneath the valley be seen, the missing faulted-down members of the fold would be found. His principal objection against the reading of the geological structure of the Great Basin accepted by many scientists, that it is a region of faulted blocks uplifted in different directions, and practically without plication, is, that this theory would involve the actual annihilation of considerable wedge-shaped segments of stratified beds by the simple action of faulting. His theories of the origin of mountain-ranges are in accordance with Suess's theories. He denies the existence of an uplifting force, but considers the faults as caused by contraction and consequent sinking, while the folding is caused by tangential pushing and crumpling of superficial strata of the earth's crust. Another object which he discusses fully is the origin of dolomites and serpentine, the origin of the intrusive masses, and the improbability of sedimentary rocks being absorbed by eruptive masses.

The second part of the volume deals with the mining industry, with the origin of the metal deposits, and the methods of smelting. The atlas contains, besides numerous sections, a reprint of the Hayden map of Central Colorado, and a topographical map of the Mosquito Range drawn so that the light falls from the north-west and at an angle of 45° upon the mountains, by which method the topographical features appear very clear and distinct.

An Inquiry into Socialism. By THOMAS KIRKUP. New York, Longmans. 12°.

THE author of this book declares himself a socialist, but he means by socialism something quite different from what usually passes by that name. He does not favor communism, nor State socialism, nor an equal division of property; and he condemns all anarchical and revolutionary methods. He would extend the powers of government to a certain extent, especially in the municipalities. But he means by socialism chiefly what other folks call co-operation, — the ownership of the means of production by voluntary associations of laborers. He remarks, as many others have done before him, that the main defect in our present industrial organization is the divorce of the laborers from land and capital. But as the individual ownership of land and capital is becoming impossible, the only way out of the difficulty is by the joint ownership of both by associations of laborers. Yet he does not propose, like most of those who call themselves socialists, to take the property away from those who now possess it without giving them compensation: he proposes to pay for it. Moreover, he does not favor doing it by the action of the State, but by the gradual extension of voluntary co-operation. In short, he lays down as the cardinal principle of socialism, that, "whereas industry is at present carried on by private capitalists served by wage-labor, it must in the future be conducted by associated or co-operating workmen jointly owning the means of production" (p. 94).

Now, it is clear that such a system as this is very different from what is commonly called socialism, and we believe that most of those that style themselves socialists would repudiate it. Certainly they show at present no inclination toward voluntary co-operation; for if they really favored it, as Mr. Kirkup does, they would set about organizing co-operative societies. We admit, however, that Mr. Kirkup's socialism is a great improvement on that which is commonly so called; but then it does not differ essentially from what economists have always advocated under the name of 'co-operation.' Most economists of the orthodox school would disagree with Mr. Kirkup in regard to extending the functions of government; but otherwise they would have little to say against the system he advocates as an ideal for the future. He paints the evils of the present system, with its millionnaires and its beggars, in a vivid light, and with too little attention to its better features; yet he admits that skilled laborers, at least, are better off now than formerly. With regard to the prospects of the system he advocates, he does not speak in the most sanguine terms; and he clearly recognizes the difficulties in the way of its establishment. Indeed, he expressly says, that, "without a great moral advance, socialism may be regarded as impracticable" (p. 159), — an opinion in which most advocates of co-operation will be likely to agree. Mr. Kirkup's style is fairly good, and he has made an interesting book; but we very much doubt if it will meet with much approval among the mass of those who call themselves socialists; while at the same time his use of the term 'socialism' to designate the system he advocates is liable to raise a prejudice against it in the minds of others.

NOTES AND NEWS.

M. MOISSAN describes, in the *Annales de Chimie et Physique*, his long-continued experiments for isolating fluorine. While all former attempts to reach this result failed, M. Moissan, after many failures and disappointments, succeeded in his endeavors by electrolyzing anhydrous hydrofluoric acid in which the double fluoride of potassium and hydrogen was dissolved. *Nature*, in describing Moissan's experiments, gives a *résumé* of the remarkable qualities of fluorine as observed by Moissan. Sulphur, brought near the orifice, at once melted and inflamed; selenium behaved in like manner; as did also tellurium, with incandescence, forming fumes, and becoming coated with a solid fluoride. Phosphorus at once took fire, forming tri-, penta-, and oxyfluorides. Powdered arsenic and antimony combined with incandescence, the former yielding drops of AsF_3. A fragment of iodine placed in the gas combined, with production of a pale blue flame; in an atmosphere of iodine vapor, fluorine itself burned with a similar flame. Vapor of bromine lost its color, and the combination was sometimes accompanied by detonation. Cold crystalline silicon at once became incandescent, and burned with great brilliancy, sometimes with scintillations. On closing the little tubes containing it with the thumb, and opening under water, the silicon tetrafluoride formed was absorbed and decomposed, with precipitation of silica. Any undecomposed silicon was found to have been fused. Debray's adamantine boron also burned in the gas, becoming incandescent, and giving off fumes. Fluorine has a most extreme affinity for hydrogen: they combine in the dark, with explosion. In one of the experiments the electrolysis was allowed to continue several hours, so that eventually the small quantity of undecomposed acid remaining in the U-tube was insufficient to keep the two gases apart: the experimenters were consequently suddenly startled by a violent detonation. The hydrogen and fluorine had combined in the dark at the low temperature of — 23°. The same detonation was afterwards brought about on a smaller scale by reversing the current. On bringing the wide-mouthed delivery-tube of a hydrogen-generator near the orifice, the detonation at once occurred, and the hydrogen inflamed. Metals are all attacked with more or less energy by fluorine, forming fluorides. Cold sodium and potassium were at once rendered incandescent. Calcium, magnesium, and aluminium acted similarly, in a more modified manner, becoming incandescent when slightly warmed. Powdered iron and manganese, on gently warming, burned with bright scintillations. Lead was attacked in the cold, and tin at a slightly elevated temperature. Mercury, as suspected, entirely absorbed the gas, forming yellow protofluoride. Silver, at a gentle heat, became coated with a beautiful satin-like fluoride, soluble, unlike the chloride, in water. Gold and platinum at 300°–400° became coated with their respective fluorides, which were decomposed again at a red heat, with evolution of free fluorine. Perhaps the strongest evidence of the intense chemical activity of fluorine is exhibited in its action upon cold potassium chloride: the chlorine was at once expelled, filling the air with its disagreeable odor, and was identified by the usual chemical tests. Chlorine was also expelled from its combination with carbon in carbon tetrachloride. All organic compounds are violently attacked by fluorine; a piece of cork at once carbonized and inflamed; alcohol, ether, benzene, and turpentine took fire immediately in contact with it. Glass, as might have been expected, is at once corroded by fluorine: some very delicate experiments were carried out with perfectly dried glass, with the same result. Many other re-actions, all interesting and all showing the immense energy with which the atoms of fluorine are endowed, were performed, but one especially ought to be noticed; viz., the action of fluorine upon water. It is a singular fact, that, whenever oxygen is liberated in the cold, there is a great tendency to form ozone: hence, when fluorine is attempted to be collected over water, the gas collected is not fluorine, but ozonized oxygen; water is decomposed by the fluorine, forming hydrofluoric acid, while the oxygen is set free, and a considerable quantity of it is converted into the more condensed form of ozone.

— A new journal for promoting the teaching of physics and chemistry is being published in Berlin (*Zeitschrift für den physicalischen und chemischen Unterricht*, Springer). It is edited by Dr. F. Poske. In an introductory note, the editor emphasizes the educational value of the teaching of physics. He says that it must show how the knowledge of physics originates, — historically and logically, — and that by doing so it is as valuable a means of education as any other science. The first number contains a paper by the eminent physicist and philosopher, E. Mach, on the teaching of the physics of heat, and another by M. Koppe on Foucault's pendulum experiment. There are numerous descriptions and illustrations of simple apparatus for demonstrating physical experiments in school.

— The third annual meeting of the Indiana Academy of Science was held at Indianapolis, Dec. 28 and 29. The following is a list of the papers read: D. W. Dennis, 'The East-West Diameter of the Silurian Island about Cincinnati;' C. R. Dryer, 'The Kames of Allen County, Ind.;' J. T. Scovell, 'Erosion in Indiana;' D. A. Owen, 'A Geological Section of Johnson County, Ind.;' D. W. Dennis, 'The Transition of *Orthis occidentalis*, Hall, into *Orthis sinuata*, Hall;' O. P. Hay, 'Notes on Some Fossil Bones found in Indiana;' O. P. Jenkins and W. V. Brown, 'Location of Eel River Falls;' J. C. Branner, 'A Sketch of the Geology of Arkansas' and 'The meanderings of the Arkansas River below Little Rock;' J. U. Nef, 'On Carboxylated Derivatives of Benzoquinone;' W. A. Noyes, '*Beta* para Nitro-toluic Acid;' J. U. Nef, 'On Chloranil;' J. L. Campbell, 'The Reversal of the Electric Current in the Holtz Induction Machine;' C. A. Waldo, 'A Method of Determining the Epicentrum of an Earthquake;' B. W. Evermann, 'The Fishes of Carroll County, Ind.;' W. P. Shannon, 'A List of the Fishes of Decatur County, Ind.;' D. S. Jordan, 'The Isthmus of Panama as a Barrier to Marine Fauna;' O. P. Jenkins, 'Notes on Some Southern Indiana Fishes;' D. S. Jordan, 'Blind Fishes and Natural Selection;' F. M. Webster, 'An Unusual Appearance of *Apatura celtis* along the St. Francis River in Arkansas;' J. S. Kingsley, 'The Origin of Anthropods;' G. G. Hubbard, 'List of Butterflies of Jefferson County, Ind.;' W. P. Shannon, 'List of Butterflies of Decatur County, Ind.;' F. M. Webster, 'Drouth, and its Effect upon Insect Increase and Decrease,' 'Distribution of Some Species of Injurious Insects, throughout Indiana, during the Season of 1887,' and 'The overflow of the Mississippi River, and its Effect upon the Species of *Simulium* (Buffalo Gnats) infesting the Smaller Inland Streams of the Adjacent County;' Amos W. Butler, 'Some Rare Indiana Birds;' Maurice Thompson, 'The Secondary Functions of the Hyoid Cornua in *Picus* and *Colaptes*;' Amos W. Butler, 'Suggestions concerning a Law for the Protection of Birds;' D. S. Jordan, 'The Origin of Genera;' C. W. Hargitt, 'Some Curious Monstrosities in Egg-Formation;' W. S. Windle, 'The Skull of *Necturus lateralis*;' J. M. Coulter, 'Evolution in the Vegetable Kingdom' (presidential address); C. W. Hargitt, 'Notes on *Scaphiopus holbrookii*;' O. P. Hay, 'Observations on the *Amphiuma*;' B. W. Evermann, 'The Occurrence of the Star-nosed Mole in Indiana;' A. W. Butler, 'Notes on Some Indiana Reptiles and Amphibians;' O. P. Hay, 'Some Additions to the List of Indiana Reptiles;' Lillie J. Martin, 'A Chemical Study of *Juglans nigra*,' and 'The Value of Organized Work in Plant-Chemistry;' O. M. Meyncke, 'The Late Drouth and its Effect on Vegetation;' Stanley Coulter, 'Histology of the Foliage Leaf of *Taxodium distichum*;' John M. Coulter, 'Stomata of *Tillandsia usneoides*;' G. G. Hubbard, 'Additions to the Flora of Indiana;' J. N. Rose, 'Characters in *Umbelliferæ*;' O. M. Meyncke, 'Companion Plants;' Walter H. Evans, 'Lichens of Indiana;' J. C. Arthur, 'Life-History of the Plum-Leaf Fungus;' O. M. Meyncke, 'Notes on the White-spored Agarics of Franklin County, Ind.;' T. B. Redding, 'Man an Evolution: Biological Proofs.'

— A meeting for the purpose of organizing the American Folk-Lore Society was held at University Hall, Harvard University, Cambridge, Mass., on Wednesday, Jan. 4. Rules for the government of the society were enacted, of which the first declares that "the American Folk-Lore Society has for its object the study of folk-lore in general, and in particular the collection and publication of the folk-lore of North America." The rules further provide that the society shall consist of members who subscribe an annual fee of three dollars; that each member shall be entitled to a copy of the journal to be issued by the society; that an annual meeting shall be held; and that the affairs of the society shall be conducted by a president and a council of fourteen members, to be elected annually. Prof. E. J. Child of Harvard University was elected president.

— The *Railway Review* of Jan. 7 says that on Dec. 31, 1885, there were 10,746 miles of railways in operation in South America, of which 4,378 were situated in Brazil. We have compiled the statements given in the *Annuario do Imperial Observatorio do Rio de Janeiro* of 1887. It appears that on Dec. 31, 1886, approximately 4,820 miles of roads were in operation, while 2,530 miles were being constructed and surveyed. The statements given in the *Annuario* are not sufficiently clear to give exact figures for the lines. The value of the information given in the annual is enhanced by tables giving the elevations of the stations. According to the *Annuario* of 1886, 4,607,213 miles of telegraph-lines were in operation, of which 1,325,894 miles are in the Province Rio Grande do Sul.

— A course of eight lectures on subjects of general interest is to be given by leading scientific men in behalf of the Marine Biological Laboratory, under the auspices of the Boston Society of Natural History. The Marine Biological Laboratory is to be a permanent station on the New England coast, where suitable opportunities and conveniences may be had for teachers, professional naturalists, and others, to collect and study the animals and plants of the sea. The project has the support of the naturalists of the country and of many liberal citizens, who have already contributed several thousand dollars toward the funds needed. The receipts from the lectures will be applied to increase the funds. If a sufficient sum is obtained now, the laboratory will be opened next summer. The following is a list of the lecturers and their subjects: Jan. 18, Prof. W. H. Niles of the Massachusetts Institute of Technology, 'Mountain Sculpture;' Jan. 25, Maj. J. W. Powell, director of the United States Geological Survey, 'Savagery, Barbarism, and Civilization;' Feb. 1, Prof. H. N. Martin of the Johns Hopkins University, 'A Hen's Egg;' Feb. 8, Prof. George L. Goodale of Harvard College, 'Seeds;' Feb. 15, Prof. F. W. Putnam, director of the Peabody Museum of American Archæology and Ethnology, at Cambridge, 'The Serpent Mound and the Ancient People of the Ohio Valley;' Feb. 22, Prof. Alpheus Hyatt, curator of the Boston Society of Natural History, 'A practical Example of the Evidence for Evolution;' Feb. 29, Dr. Henry P. Bowditch, dean of the Harvard Medical School (subject to be announced); March 7, Prof. Edward S. Morse, director of the Peabody Academy of Science, Salem, 'Reptilian Affinities of Mammals.'

LETTERS TO THE EDITOR.

**** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

Twenty copies of the number containing his communication will be furnished free to any correspondent on request.

The editor will be glad to publish any queries consonant with the character of the journal.

The Trinity Formation of Arkansas, Indian Territory, and Texas.

DURING the past field-season the writer has had an opportunity to study the small mesozoic area in the south-west corner of the State of Arkansas and south-eastern Indian Territory, which is the north-eastern termination of the great area so well developed to the southward in Texas. By courtesy of Dr. John C. Branner, State geologist, I am permitted to publish the following note in advance of the more detailed official report which will soon be published by him.

In previous papers (*American Naturalist*, Feb. 1887; *American Journal of Science*, April and October, 1887) I have shown that the mesozoic strata of the Texas region, instead of belonging to the uppermost cretaceous as had been previously supposed, really embraced a large series of lower cretaceous and perhaps Jurassic beds. To the last-named period I intimated that the strata in Parker County, Tex., provisionally termed in my section the 'Dinosaur Sands,' would probably be found to be related. The studies of the past season in Arkansas have shown that these strata exhibit great uniformity of deposition along the paleozoic and mesozoic parting from south of the Brazos River in Texas, to the Little Missouri River near Antoine, Pike County, Ark., a distance of over three hundred miles, and that they rest directly upon the highly disturbed carboniferous rocks. In Texas the areal extent of this formation coincides with the eastern half of the Upper Cross Timbers, and in Arkansas it extends from the point above mentioned westward to beyond Ultima Thule. Its width, except for a few miles on each side of Red River, never exceeds a few miles. The formation consists of alternations of fine, closely packed white sands and red and blue gypsiferous marls, with occasional alternations of thin but extensive, fissile, arenaceous, and crystalline limestones, highly fossiliferous, often wave-marked, and seldom more than ten inches in thickness. Extensive strata of pure saccharoidal gypsum also occur in places, and the formation is the source of the salines and salt licks throughout its extent, and probably also of the 'brackishness' of the rivers which intersect it.

This formation is clearly distinguished from the overlying cretaceous (which deposits are later and later as we proceed eastward along the contact) and the underlying carboniferous. West of Weatherford the basal Comanche series may be seen resting directly upon it, while, at the point of its disappearance under the newer strata in Arkansas, it is directly covered by the uppermost cretaceous of Hilgard's Mississippi section.

The fauna of this formation is littoral and of great uniformity throughout its extent, and, upon hasty observation, conveys an impression that it is later than it really is. It consists of characteristic molluscan species which are hardly distinguishable from certain characteristic European forms specially indicative of the Upper Jurassic and Wealdan. I hope to give more detail concerning these fossils in a special paper hereafter. In Texas I found what are at present supposed to be dinosaurian remains; and occasional vegetal remains are met with.

To the continuous formation the name of 'Trinity' is applied, from the rivers of that name which arise in it. This includes the strata which I termed 'Dinosaur Sands' in my Texas section.

The discovery of these trans-Mississippi beds of Jurassic affinities is of importance, in that it indicates a close relation and possible continuity between the pre-cretaceous mesozoics of Colorado and the Texas Pan-handle, and the Tuscaloosa and Potomac beds of the cis-Mississippi region. ROB'T T. HILL.

U. S. Geol. Surv., Washington, D.C., Jan. 6.

Children's Development.

RECENTLY I became interested in the vocabulary of my boy, thirty months old, and for one day noted all words used by him, except proper names. No effort was made to exhaust the child's stock of words by questioning. He used three hundred and fifty-two words, of which fifty-four per cent were nouns, eighteen per cent verbs, and eleven adjectives. It is probable that the child's entire vocabulary of dictionary words includes four hundred or more. G.

Washington, D.C., Jan. 4.

Is there a Venomous Lizard (Heloderma)?

THIS animal has been an object of considerable interest to naturalists because of the question whether or not it presents the anomaly of a venomous lizard. Just before leaving the United States, last September, I had under my care about twenty so-called 'venomous lizards' of various ages and sizes; and, as I believe the biography of this animal has been but slightly touched on, a few observations in regard to them may not be out of place.

They varied in length from 19 to 49.5 centimetres. The larger ones, say above 43 centimetres, were all females. Their colors ranged from almost a brick-red to pale pinkish white, with markings from black to vandyke brown, which showed no regularity in details, appearing as if each lizard had been the subject of some Chinese artist who aimed only at the general effect. They all came to my father's establishment, in Rochester, by express; and the shaking-up and lack of freedom that they had undergone served to make them very irritable. When first liberated from their confining boxes, their first desire was to get hold of the nearest person, and, although usually very sluggish, they would then move with surprising agility, turning end for end, and making short dashes hither and thither with great swiftness. When one succeeded in fastening its teeth in my clothes, it held on with the tenacity of a bull-dog, occasionally giving a vicious shake to its head, as if trying to tear away a piece of the cloth. Nor was this pugnacity confined alone to the time of their arrival, but continued in lesser degrees during the entire time that I had them under observation. Once I saw a pitched battle between two. One had its teeth firmly fixed in the throat of the other, who, in turn, had a leg of the first in its jaws. Together they rolled and twisted over the floor, neither relaxing its hold for a period of fifteen minutes. Blood was drawn on both sides, yet neither afterwards appeared the worse for the conflict. I then tried two of them on a hen, to ascertain if they would prove poisonous to her. Having first shaved the thigh of the hen, so that the feathers might not interfere wth the entrance of any poison, I induced one of the lizards to take hold. This it readily did, and retained its grip for five minutes, occasionally shaking its head in a savage manner. During the operation the hen appeared quite impassive, and, although not tied, made no attempts to escape, evidently charmed by the lizard. A little blood was drawn, showing that the flesh had been thoroughly pierced. For perhaps a half-hour afterwards the hen appeared a trifle stupid, but soon regained its normal condition, and gave no signs at all of poisoning. Two days later I repeated the experiment with another lizard, with a similar lack of results. I then caused one of them to bite the edge of a saucer, and, with a hypodermic syringe, injected the fluid obtained in the breast of a pigeon. No effect. Then, exciting one so that it viciously bit a small piece of wood, I drew a considerable quantity of fluid direct from its mouth, which, injected into the pigeon's breast, produced no results.

However, birds and lizards are bad subjects for experimenting upon with supposed poisons, and do not conclusively prove that they might not be poisonous, or perhaps even fatal, to man. But being very busy at the time, I had no opportunity to carry my experiments further.

The forked tongue continually playing in and out of the mouth like a serpent's, the snake-like hiss, and the bright colors, together with their aggressive disposition, are well calculated to excite the suspicions of the Arizona Indians, who are reputed to greatly fear and thoroughly believe in the extreme venomousness of this reptile.

When intent on going anywhere in particular, their gait changes from a dragging of the body along the ground to that which an alligator assumes under similar circumstances ; i.e., the body is carried high on the legs, clear from the ground, and the tail carried rigid and in line with the body.

They showed a peculiar fondness for water. When placed in a large tank with sloping bottom, in one end of which was water, all would spend most of their time lying where it was about an inch deep. This appears strange when recalling the arid character of the plains that they inhabit.

Their rations consisted of raw hen's-eggs, one of which made a full meal for a good-sized individual, which would not appear to care to dine more than once in about four days. These were given whole to the larger ones, which, having gotten the egg fairly in their jaws, experienced no difficulty in breaking the shell. Their mode of eating is by running the tongue into the mass of the egg, drawing it into the mouth, repeating this in a very deliberate manner, and spending from twenty minutes to a half-hour on an egg.

Their ability to climb is considerable ; quite out of keeping with their heavy, unwieldy appearance. A tolerably smooth stick, an inch in diameter, standing at an angle of about sixty degrees, is quite easily ascended.

Several of them laid eggs during August and September. These were 53 millimetres long by 26 millimetres in transverse diameter, were perfect ellipsoids, having a finely granulated, soft, tough, translucent skin or shell. HENRY L. WARD.

Tambaya, D.F., Mex., Dec. 25.

Sections of Fossils.

IN *Science* for Nov. 18, Prof. Joseph F. James, in speaking of the production of sections of *Bryozoa* for microscopic examination, says, "I can quote no higher authority than Mr. Archibald Geikie (*Text-Book of Geology*, pp. 85–88, where elaborate directions are given for making rock sections ; Professor Prestwich also considers it 'an expensive and tedious process,' *Geology*, i. p. 43) as to the tediousness of the process." The pertinence of these references immediately vanishes if a person take but the pains to look them up. In both it will be found that the authors have been referring to the making of slides of Plutonic and metamorphic rocks. Of course, any one knows that a limestone in which *Bryozoa* are usually embedded cuts far more readily than crystalline rocks. Now, with a little practice, a man can soon cut from six to ten slides of crystalline rocks in a day ; and he can cut six times as many slides of calcareous *Bryozoa* in the same time, as I have often seen done by college students, not by lapidaries. An average of from forty to sixty slides a day certainly cannot be complained of. Of course, no one will deny that the use of the microscope in fine petrographical studies of crystalline rocks has become imperative. We are here referring to *Bryozoa*.

Feeling convinced, from my own study of the writings of these authors, that they had never expressed an opinion of this subject, least of all with special reference to the *Bryozoa*, I sought for further information. Under date of Dec. 10, Prof. Joseph Prestwich writes me, "The question you ask about the *Bryozoa* is quite beyond my knowledge. I have never studied the *Bryozoa*. In fact, there are very few persons in England who have studied them. We lost our great authority in my old friend Mr. George Busk." In a letter dated Dec. 8, Prof. Archibald Geikie writes, "The question you propose to me in your letter is really one to which I do not feel myself competent to give an answer. I haver never given special study to the *Bryozoa*, and I have nowhere ventured to publish an expression of opinion."

The sentence quoted from Professor James's article concludes with the following words : "nor a better one than Dr. Nicholson as to the uncertainty of the results." In my article of Nov. 4, I mentioned Prof. H. A. Nicholson as one of the leading men who first took a decided stand in favor of the prominent use of internal characters as a means of classification. Now, it would not be fair to construe the above sentence as meaning that Professor Nicholson's writings are themselves a manifest example of the viciousness of the methods pursued by the new school. It must mean, therefore, that Professor Nicholson does not believe in the use of these microscopic sections. Since we interpret the spirit of Professor Nicholson's 'Genus Monticulipora' (1881) and 'Tabulate Corals' (1879) so differently, it will certainly be fair to quote his later writings, since they at the same time must contain his more mature views. Thus in the *Annals and Magazine of Natural History*, February, 1884, he writes, "The earlier observers of these fossils, as, for example, Mr. Lonsdale, necessarily founded their names upon macroscopic characters principally, the method of investigation by means of thin sections being of recent origin ; and they also gave, as a rule, extremely brief descriptions. Hence it is exceedingly difficult, in many cases, among the monticuliporoids, to be certain as to the precise forms to which the older names should be attached." Then he proceeds to an investigation of both external and internal characteristics, accompanying the same with figures, of which those illustrating internal features alone are of value. In the number for December, 1885, he and Foord discuss the genus *Fistulipora* on the basis of the new light cast upon it by an investigation of the internal structure. Again in May, 1886, they make use of this method when they say, "Having recently had the opportunity of making a microscopical examination of a very extensive series of these forms, we have satisfied ourselves that they cannot be referred to the genus *Chætetes*, Fisher." And they propose the new genus *Rhaphidopora*. The plates 15, 16, and 17, accompanying this article, do not leave any doubt as to the position taken by these authors. The same is true of an article published by Nicholson and Etheridge in the same journal (March, 1886), where indeed they go so far as to separate *Stenopora australis* from *S. ovata*, with which "the specimens in question agreed entirely in external form and in macroscopic characters," solely on the basis of distinct internal features.

I cannot do better to express the opinions which actuate the new school of students than to quote from a letter from Prof. Archibald Geikie : "The common-sense view of such questions seems to me to be this. In dealing with fossils we are precluded in a vast number of cases from appealing to the evidence of internal structure, for it has not been preserved. Hence, if an organism can be satisfactorily determined from external characters, that is the most desirable means of identification, for it is the most generally applicable. If external characters are proved to be insufficient, and even misleading, we must fall back on internal structure when we can get it." Now, the new school believe that external characters often are misleading, where internal characters may more safely be followed. Since any *Bryozoa*, to be determined even according to the old method, must have the minute external structure well shown, and since in these cases the minute internal structure is also usually well preserved, we believe that the new method is eminently practicable. Nobody denies that external characters may be of great additional assistance. AUG. F. FOERSTE.

Cambridge, Mass., Dec. 29.

Weather-Predicting.

IT has become a well-worn adage that half of the disputes would be avoided if the disputants had a thorough mutual understanding of the terms used by each. In weather predictions and verifications a clear understanding of the meaning of the terms used certainly seems very necessary. If a weather-predictor concludes that a satisfactory definition of a fair day is one on which less than .01 of an inch of rain falls, and a foul day is one on which more than .01 of an inch falls, and makes predictions accordingly, his predictions, when verified by this rule, will give a certain success in proportion to his skill. If, now, some one should object to cloudy days without rain being called fair, and record all cloudy days for which fair weather had been predicted as failures, he would give the predictions a much lower percentage of success than by the first method. If he should go still further, and object to calling a day foul unless at least .05 of an inch of rain fell, and proceed to verify the above predictions accordingly, the percentage of success would rapidly approach zero. By disregarding this evident truth, Prof. H. A. Hazen has, in his letter on p. 322 of the last volume of *Science*, involved himself apparently in great confusion.

Mr. Rotch and the writer have during the last year published statements showing that local predictions issued from the Blue Hill Observatory for longer periods in advance than those issued by the Signal Service for this vicinity have had a higher percentage of success than the predictions of the latter. Some of these statements were copied in the notes of foreign meteorological journals, and were prominently referred to in an article by Dr. Klein.

In September, 1887, letters were received from Professor Hazen in which he referred to these statements, and said that our supposed higher success was 'all moonshine,' and was entirely due to our methods of verification. Moreover, he said it was unfair to verify predictions made for Massachusetts by the Boston record alone, and proposed that he and the writer should try together predicting for Boston alone. This seemed eminently fair, and the writer agreed to it; but, to make sure that both had a clear understanding of the meaning of the terms to be used, definitions of the terms 'fair weather,' etc., used by the writer in making predictions, published by the Associated Press of southern New England, were sent to Professor Hazen. He materially modified these, and sent the following definitions and rules. The temperature rules are omitted.

PLAN FOR WEATHER AND TEMPERATURE PREDICTIONS AND VERIFICATIONS AT BOSTON AND WASHINGTON (ALL VERIFICATIONS TO DEPEND ON THE OBSERVATIONS [TAKEN TRI-DAILY AT BOSTON]; PREDICTIONS TO BE MADE AT OR BEFORE 2 P.M., TO HOLD FROM MIDNIGHT TO MIDNIGHT).

Prediction: Fair Weather.— Successful: if fair three times; cloudy, fair, clear in any order; and any cloudiness less. Failure: if cloudy twice in any order; cloudy, fair, fair in any order, and any cloudiness above; a drop of rain.

Prediction: Threatening.— Success: if cloudy twice in any order; cloudy, fair, fair and any cloudiness above; rain .01 or less. Failure: if fair three times; cloudy, fair, clear in any order; and any cloudiness less; rain over .01.

Prediction: Rain.— Success: rain at any time over .01. Failure: rain .01 or less and any cloudiness.

Predictions were begun according to these rules, and the writer sent Professor Hazen a prediction during each day in October except on Sundays. Professor Hazen has correctly given these predictions, with the corresponding weather at Boston, on p. 323 of the last volume of *Science*. If any one will take these tables, and carefully verify the predictions in accordance with the above rules, he will find that sixteen of the predictions in Column 1, which represent the Blue Hill predictions, were verified, that is, sixty-four per cent of the whole; while only twelve of No. 2 (Professor Hazen's) were verified, or forty-eight per cent of the whole. This excess of sixteen per cent for Blue Hill apparently did not suit Professor Hazen, and he proceeds to obtain from Professors Russell and Upton other definitions and rules for verifying fair, threatening, and rainy weather; and, finding that these give a higher per cent for No. 2, he omits entirely to give his own rules. The writer likes Professor Upton's scheme better than that of Professor Hazen, only his predictions were not made in accordance with such a scheme. The predictions sent to Professor Hazen were not made to be verified in detail, but only to agree with his rules; and it so happened, that, while the writer was predicting with Professor Hazen, he was also predicting for the Boston papers; and when he predicted in these, "rain followed by fair weather," or *vice versa*, he merely wrote on Professor Hazen's card "rain," because, according to Professor Hazen's rules, any rain of over .01 of an inch was to be accounted success. Hence it is seen to be manifestly unfair to verify them by other rules.

According to the definitions sent to voluntary observers by the Signal Office, a fair day is one on which less than .01 of an inch of rain or snow (melted) fell, while a foul day is one on which .01 of an inch or more fell; and the writer was recently told by one of the predicting officers of the Signal Service that this was virtually the method used in the official verifications.

At Blue Hill this definition has been adopted, and hence the predictions are exactly comparable with those of the Signal Service. For October the Blue Hill predictions thus verified gave a percentage of success of eighty-five, while the Signal Service predictions only gave fifty-eight per cent for this vicinity. In both cases Sundays were omitted. Professor Hazen knew how this percentage was obtained, and yet in his letter to *Science* he writes as if it were a surprising thing that the same predictions should give eighty-five per cent when two things were considered, and only sixty-four per cent when three things were considered, in the verification.

H. HELM CLAYTON.

Blue Hill Observatory, Jan. 4.

American Microscopes.

IN my letter to *Science* (x. No. 252) in regard to American microscopes, I stated that my opinion in regard to them was based upon the examination of those brought to me by students. I hoped thus to avoid the appearance of claiming to have made an exhaustive examination of all forms of American microscopes. I regret that I did not make an express disclaimer.

Dr. Prudden has placed me under obligation by his very courteous letter in *Science* of Dec. 23, which calls attention to Grunow's new stands. Dr. Prudden's surmise that I was unaware of Grunow's recent work is correct. It is with much pleasure that I now learn that he is endeavoring to meet so admirably the demands of professional biologists and the needs of students.

Mr. Edward Bausch considers me unjust, if I do not misinterpret his letter (*Science*, Dec. 23). He appears to me to have overlooked that I wrote only in regard to microscopes suitable for biological, and particularly histological work. I have heard that the elaborate American stands were favorites with amateurs, but in regard to that point I expressed no opinion. I believe, however, that the increased demand for what is known as the continental stand is due to the rapid growth in numbers of those who use the microscope as a professional instrument, and to the extensive introduction of laboratory work in histology as a part of the course of instruction in our colleges and medical schools.

In regard to the Harvard microscope, Mr. Bausch may recollect, that, when he first came to consult me, I then urged upon him the advisability of frankly imitating one of the Zeiss stands. This advice he decided not to follow. At the time of his second visit I think that I again expressed to him the same advice. I also counselled him to make certain essential and some minor alterations. He made all of the latter, none of the former, if my memory is correct. He subsequently sent me a stand and two objectives to test. In reply I wrote the opinion which he has quoted in his letter, and which I see no occasion to alter now, but am compelled to append a remark for my own justification. The remark is, that I have since then examined a number of the Harvard microscopes brought to me by students. The stands have been of fairly good workmanship, but the objectives I have found, by conscientious examination, to be not infrequently of inferior quality, and most decidedly not satisfactory. As far, therefore, as my experience enables me to judge, I still feel disinclined to bestow the commendation upon these special American microscopes which I am ready to give to some of their foreign competitors.

My letter was not intended to impugn the honesty of the American manufacturers of microscopes, and I do not wish to do so at all. I do wish to call attention to the fact that their policy has been to supply instruments, which, however suitable for certain persons, are not as satisfactory for the work of the professional biologist, the medical practitioner, and of students, as are certain of the European microscopes.

It is to be hoped that Professor Ryder's interesting letter will bring about the result he suggests, of having a competent committee take up the consideration of the best attainable microscope. For my own part, I feel much pleased with a German stand of quite new model, which I purchased last summer. After using it a good deal, I have little change to wish for in it. If it should please others equally, it may be considered to represent an advance towards the ideal anticipated by Professor Ryder. As to the duty on scientific instruments and books, probably the scientific men of the country object unanimously. One of them said to me once, "When I express myself mildly, I call it a disgrace to the country and an outrage on science." *Science* might accomplish a valuable service by collecting and publishing expressions of opinion on this part of the tariff from some of the leading scientific men of the country. Would not a petition to Congress to abolish the duty on scientific instruments and books in foreign languages find many and distinguished signers? CHARLES SEDGWICK MINOT.

Boston, Dec. 23.

Arkansaw and Kansaw.

WHERE can one find a copy of the law fixing the pronunciation of 'Arkansas'?

As I remember the phraseology, it runs thus: "Each *a* shall be sounded as *a* in 'father,'" or, "Each *a* shall have the Italian sound of *a*, as in 'far,' 'father,' etc." This would require us to pronounce the name 'Ar′-karn-sar' (not dwelling on the *r*) or 'Ah′-kahn-sah.' Mr. Hill pleads for consistency in pronunciation (!): is *he* consistent? How can he be when he gives three distinct values for the *a*'s in 'Arkansas'? If the last *a* should be sounded as *aw* in 'law,' consistency would require us to say 'Aw′-kawn-saw.' The final '-saw' hardly represents the common pronunciation of early writers, as there was a great diversity. We find, 'Acan*sea*,' 'Acan*sias*,' 'Accan*ces*,' 'A Kan*cea*,' 'A Kan*saes*,' 'A Kan*se*' (Marquette's 'A Kan*sea*,' Jefferys' 'A Kan*sis*'), etc. All of these will appear hereafter in 'Indian Synonymy,' when published by the Bureau of Ethnology.

Though not a New Englander, I propose to adhere to 'Ar-kan′-sas' when speaking the English name, and 'A′-kan-sa' when I use the Indian one, though I run the risk of being thought inconsistent.

As to 'Kansas,' how can Mr. Hill say that 'Kan*saw*' was the early Anglo-American pronunciation, when he gives Long's 'Konza' (i.e., 'Kon′-zay' or 'Con′-zay') as an approximation of the true pronunciation? 'Kan′-ze' (*n* a vanishing nasal, *a* as in 'father,' *e* as in 'they') is the name of the Kansa, Kansas, or Kaw tribe, as given to me by the Indians themselves. This agrees with what I have gained from cognate tribes, the Omahas, Ponkas, and Osages. The early French forms of the name are 'Canzé' (1722), 'Cansez' (1701?), 'Canses' (1702), 'Çanzez' (1758), 'Canzas' (1774), 'Kancas' (1753), 'Kansé' (1722), 'Kanses' (1702). Early Anglo-American forms are 'Cansa' (1705), 'Kansæ' (1741), 'Kanzas' (1695), 'Kansez' (1761), 'Kanses' (Pike), and 'Kar′-sa' (LEWIS and CLARKE, *Discov.* 1806, p. 13).

The Quapaws or Kwapa say that they were originally part of the Kansas, and the former are the same as the Akansa. Query: was 'A Kansa' or 'A Kanze' ('A-Kan-sæ,' Coxe, 1741) derived from 'Kanze'?

There has been a tendency on the part of some Americans to change the Indian *a* as in 'father,' and *e* as in 'they,' to *aw* as in 'law.' Thus: 'U-ga′-Khpa' ('Oo-gŏkh′-pah') is now 'Qu*aw*-p*aw*,' or 'Quap*aw*;' 'Wa-zha-zhe' (War-zhar′-zhay'), or 'Osage,' is given as 'Was-ba-*shaw*;' 'Pan′-ka' ('Pahn′-kah'), as 'Pŭn-*caw*;' and 'U-ma′-ha' ('Oo-mah′-hah') as 'O-m*aw*-h*aw*.' So 'Arkans*aw*' and 'Kans*aw*.' I protest against such cacophonies, which are neither English nor Indian. When the regular Indian pronunciation of a word cannot be retained, let us use one that is euphonic English. J. OWEN DORSEY.

Bureau of Ethnology, Washington, D.C., Jan. 3.

Cheyenne.

MR. WILSON says (*Science*, Nov. 11, 1887, p. 239) that *Shah-ee-aie loo-hah*, said by the Dakotas to the first Cheyennes met by them, means 'you have painted yourselves red.' Its real meaning is, 'you have or possess (*loo-hah*) a Cheyenne (*Shah-ee-ay-lah*).' *Lu-ha* (*loo-hah*), 'you have' or 'possess,' is from *yu-ha* (*yoo-hah*), which cannot be used as an auxiliary in forming the perfect tense (for which there is no exact Dakota equivalent). 'You have painted yourselves red' must be expressed by *shah-nee′-ch′ee-yah′-pee*, in which *shah* is 'red;' *nee-ch′ee*, reflexive pronoun, second person; *yah*, causative; and *pee*, the plural ending. J. OWEN DORSEY.

Bureau of Ethnology, Washington, D.C., Jan. 3.

The Eskimo Ring-Finger.

WE found the habit of wearing finger-rings quite general among the Eskimo of Point Barrow during the two years we spent among them (1881–83). These rings are generally made of brass, rarely of silver, and it was quite natural to suppose that they learned the fashion from American whalemen. The ring, however, is always worn on the middle finger, and indeed received its name (*katŭkqle-rŭñ*) from *katŭkqlŭñ* ('middle finger'), corresponding to the Greenlandic *kiterdlek* (literally 'the middle'). This circumstance was supposed to be merely accidental, especially as the word used in modern Greenlandic for ring does not indicate any particular finger, meaning simply 'the thing which belongs on a finger' (*agssangmio*).

The use of rings is not mentioned, as far as I can tell, by any writers who have described the Eskimo (though *agssangmio* occurs in Kleinschmidt's Dictionary), and every thing favored the belief that the fashion was merely local at Point Barrow and in Greenland (and possibly elsewhere), and had been learned after they had come in contact with civilized people.

I was not a little surprised, therefore, when I had an opportunity of consulting the earliest Eskimo dictionary (that of Paul Egede, published in 1750), to find given as a derivative of the word *kiterdlek* (which, by the way, appears in the form *katertlek*, decidedly nearer the Point Barrow pronunciation), *katertleraut* ('a ring:' "annulus, quia Groenlandi annulum in *medio* digito gestare").

Whatever may be the fashion nowadays in Greenland, it is quite plain that in Egede's time the Greenlanders, like their more unsophisticated cousins at Point Barrow, not only wore the ring on the middle finger, but named it from that finger.

Moreover, the word for 'ring' in the Mackenzie River dialect (*kpitep-klopon*) indicates a similar fashion in that region. Such a coincidence in widely separated branches of the same race could hardly be the result of accident. Nor is it easy to see how any circumstances of environment could have affected such a trifling matter as which finger a ring should be worn on.

Evidently, therefore, before the Eskimo had separated into their present branches, they ornamented their hands with rings, which they wore on the middle finger, and not on what the white race have for ages considered as the ring-finger.

The question of the position of the ring-finger may appear, as I have called it, a trifling matter; but I think I have shown it to be a link in the chain of evidence connecting the different branches of the Eskimo race, and, as such, worthy of consideration.

JOHN MURDOCH.

Smithsonian Institution, Jan. 4.

Queries.

22. WASP-STINGS. — I have often, from childhood to the present time, heard the assertion that while one holds his breath it is impossible for him to be stung by a wasp. I have till recently always dismissed the assertion with the same smile that I have the statement that swallows hibernate in the mud, or that Friday is an unlucky day. My only reason now for asking place in the columns of *Science* for a question concerning it is the persistent assertion, made by a gentleman of the highest intelligence, whose opinions and judgment are of recognized value in scientific as well as other departments of thought, that the statement is true. Unfortunately, my own experiments have only been with wasps that were rendered somewhat torpid by cold weather, and count for nothing either way. I cannot learn that similar claims are made in regard to bees or hornets; nor can I learn, from those who make them in regard to wasps, whether it is claimed that the act of holding the breath renders one's skin impervious to the wasp's sting, or whether it in some way changes the nature of the virus or of the sensitiveness of the flesh to it. The assertion simply is, that any one may, while holding the breath, handle the liveliest and most able-bodied wasps with perfect safety, and also without after-pain or ill effect from any efforts of the wasp made while respiration was suspended. Can any readers of *Science* prove or disprove these assertions, and, in case they are sustained, give any theory whatever in explanation? C. H. AMES.

Boston, Dec. 28.

—Elsewhere we print a splendid showing of the Mutual Reserve Fund Life Association. Mr. E. B. Harper, president of the association, and one of the most wide-awake, alert, and successful insurance presidents in the world, says that the institution has had a most successful year. During 1887 the company paid to widows, orphans, and claimants of deceased members, $1,400,000, and saved to its living members by reduction of premium rates below the rates charged under the old system of life insurance more than $3,000,000. The cash surplus of the company which stands to the credit of persistent members of five years' standing equals a dividend of more than 30 per cent upon the entire mortuary premiums paid by such members. This in addition to the 50 per cent reduction in the premium rates charged its members is, to say the least, a wonderful showing. The cash surplus at the close of the year is over $1,350,000, and the total payments to the widows and orphans and beneficiaries of deceased members exceed $4,100,000. The company makes the extraordinary statement that while furnishing life insurance at less than half the usual rates under the old system, its actual cash profits for the year foot up $1,227 for each day in the year, including Sundays and holidays, every dollar of which is set apart for the credit of the members of the company. This is a statement that is worthy the attention of those who are seeking life-insurance.—From the *Albany Evening Journal*, Jan. 3, 1888.

SCIENCE.

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SCIENCE

FRIDAY, JANUARY 20, 1888.

WASHINGTON SEEMS DESTINED in the not very distant future to become a leading scientific centre for the student of natural history. The Smithsonian Institution and the National Museum have long offered unsurpassed facilities for research in most branches of science, although there has been a lack of facilities for the study of natural history from live subjects. The National Museum, however, has taken a step in the right direction at last, and has made a collection of live animals, which, though unimportant at present, may prove the nucleus of what may, with proper congressional aid, be made the most valuable zoölogical collection in the country. In addition to this, the Fish Commission is preparing a fine collection of fresh and salt water fishes, mostly confined to those of economic value, but which will incidentally contain many varieties of marine life not valuable for food, but interesting for study. There are at present about forty varieties of fresh fish on exhibition in addition to the regular hatcheries of carp, shad, etc. The most interesting of these is a small fish from South Carolina, which brings forth its young alive, as animals do, instead of in the form of eggs, as is almost the universal custom of fishes. In another tank may be seen nearly one hundred Mississippi River catfish from a river in the neighborhood of Quincy, Ill. These are Western fish, and the Fish Commission intends to introduce them into Eastern rivers on account of their great value as food-fish. The flesh is white, firm, and of fine flavor. The present experiment is to determine whether they will spawn in captivity. Another tank is full of beautifully marked goldfish originally from Japan. Goldfish are not indigenous to any part of America, and are all of Asiatic or Japanese origin, the latter being much the handsomest. Several specimens of the California grayling, the gamest of all the gamy fishes, are also to be seen. A fine collection of salt-water fauna will also be brought from Wood's Holl, Mass., where it has been for some months, and placed on exhibition in Washington. In addition to the various food-fishes of the ocean, the exhibit will contain many other interesting forms of sea-life. The location of the exhibition in the Armory Building leaves much to be desired, and it is but poorly adapted for the needs of the work. Such a collection should be located in a building built expressly for the purpose, which will, in all probability, be ultimately erected. The exhibit of salt-water fishes is intended, in addition to its affording valuable means of study, to demonstrate the feasibility of keeping a collection of ocean fauna at a point remote from the sea. The water used will be artificial sea-water, and the experiment has never before been made on so large a scale. The difficulties attending the transportation of sea-water prevent such exhibitions at any distance from the sea. The exhibit will be tastefully and conveniently arranged. The asphalt floor is always dry, and the display interesting and instructive to the layman as well as to the scientist, and will also give valuable aid in the other work of the Fish Commission.

IN THE JANUARY ISSUE of the *Journal of Mental Science*, Miss Ellen F. White gives a most interesting account of medical gymnastics. We hear in this country more or less about the Swedish movement-cure, but it is quite usual to regard it as simply a new phase of quackery. It is, however, something very far removed from quackery, and Miss White's paper on it makes this very clear. Ling, the originator of the system, was a Swedish officer, who happened to discover that a lameness in his own arm was cured by fencing. He reflected on this fact, and then made an exhaustive study of anatomy, physiology, and pathology for the purpose of testing the principle which he thought he had discovered. As a result he evolved his system; and it includes medical, military, and educational or hygienic gymnastics. The object of the latter is to preserve the balance of power in the body: that of the former is to restore the balance when it has been disturbed by a loss of the proper proportion between the parts. The theory premises that blood is the carrier of life and of disease, and that the flow and the quality of blood can be controlled, or at least regulated, by gymnastics. The writer instances a number of cases and of affections which substantiate these claims, and describes the various classes of movements, and explains their nature and aims. She mentions the fact, which is very evident to us in the United States, that hundreds of so-called gymnasts, who may have been a few months or a few weeks only under a teacher, are advertising themselves as specialists, and bringing discredit upon the whole system. If it is to establish itself in the public confidence, it must be taken out of the hands of charlatans and quacks.

THE UNITED STATES HYDROGRAPHIC OFFICE.

AN important bill has just been introduced in Congress by which it would seem as though the continued efficiency of this office, both as regards its relation to the navy, of which it is a most important and necessary adjunct, and to commerce and the entire maritime community, would be insured. The bill referred to provides for the appointment of a permanent hydrographer and assistant hydrographer, to be nominated by the President and confirmed by the Senate.

Few landsmen are in a position fully to appreciate the scope and character of the work done by this office, much of it being of a purely technical character, involving the preparation of charts, sailing-directions, light-lists, etc., for the use of navigation in every port of the globe. Until recently, however, the tour of duty of the officer detailed as hydrographer has been so short, in accordance with the usual custom in the navy, that it has been impossible to do more than keep up the routine work of the office, which in itself requires unremitting attention and care. Thanks to a longer detail than usual, granted by Secretary Whitney at the request of the chief of Bureau of Navigation, in order to develop the latent possibilities of the office, the present hydrographer has succeeded in lifting it out of the old ruts in which it was moving, and has infused into it renewed life and energy; so much so, indeed, that it is now fully recognized as one of the great scientific bureaus of the government, and the cordial assistance and support which it is receiving from masters of vessels show far more forcibly than words can do the great practical value of its work. Branch offices have been established at six of our principal seaports, and with such success that more are demanded at other ports; American charts and other hydrographic publications have come to the front again; and last, but by no means least, the monthly Pilot Chart, a publication which is unique of its kind, has been established, and has obtained an influence and importance well attested by the fact that a large edition is generally exhausted in a few days after it is issued. All those of our readers who have crossed the Atlantic during the past three years have probably had an opportunity to form their own ideas regarding the esteem in which it is held by masters of vessels.

To keep such an establishment moving smoothly, economically, and efficiently, undoubtedly requires a longer tenure of office for its responsible head than the three years prescribed by naval custom; and the bill which is now before Congress must receive hearty and undivided support from the scientific world, no less than from owners and masters of vessels, marine insurance companies, and, indeed, from the general public, for who is not interested in lessening the hazards of the sea? The relations which have grown up and the interchange of data now carried on between this office and other scientific bureaus of the government, no less than the recognized value of this most appropriate work for naval officers in times of peace, mark a new era in naval administration, the permanency of which should be guaranteed. The people of the United States are quick to recognize good work, and nothing can strengthen confidence in and support of the navy more than the assured permanency of the praiseworthy work of the Hydrographic Office.

THE GROWTH OF CHILDREN.

THE systematic measurement of the several parts of the human body, together with the testing of their functions, has developed into the science of anthropometry. The plan of establishing an anthropometrical laboratory, where, for a small fee, any one can have himself weighed, measured, and his powers tested, which Mr. Galton has so often and so ably advocated, seems about to be realized. The results of such measurements, when widely taken and ably compared, will be to practical biology and hygiene what statistics, in the present use of the term, are to economical science, — the experimental basis of their practical application. As in the latter, so in the former, the stating of these results in accurate form at once opens up a number of questions never before considered, and at the same time helps to solve those that have been brought to notice. In this department of study no field has been cultivated with so much zeal as the study of the growth of children, mainly because this is a field where the practical lessons can be most effective. In a recent number of a German scientific journal, Professor Gad of the University of Berlin, sums up the recent studies upon the growth of children, and thus makes accessible some very interesting facts.

About one-fourth of a human life is spent in the period of growth; and this implies not merely addition of material, but assimilation, re-formation. It involves, too, in some cases, the enlargement and change of form of elementary cells, but in most cases the formation of new cells by cell-division. We know more about the growth of the skeleton than about that of the soft parts of the body; but a more detailed knowledge of the growth of its several parts is highly desirable. The height and weight of the entire body are the most readily observed, and about them the information is most accurate. The female child weighs, on the average, 3, and the male 3.5 kilograms. At the fifteenth year the weight has become twelve times this amount. The greatest changes occur in the first year. At the end of the second year, the body weighs three and a half times its original weight, and about one-fifth more than at the end of the first year. In the third year it increases by one-tenth its weight; and from then on, the increase is tolerably constant up to the eighth year for girls, and the tenth year for boys, at about 1,500–1,800 grams per annum. The increase in height takes a parallel course. The greatest changes occur in the suckling. At birth the height is 50 centimetres, which is about one-third that of the adult. At twelve months it has increased by 20 centimetres (40 per cent), more of this increase going to the lower than to the upper half of the body. In the second year the increase is 10 centimetres (15 per cent); in the third, 7 centimetres (8 per cent); and from then on, it is about 5 centimetres annually. At five years the height has doubled, and at fifteen tripled itself. This for boys. Girls are smaller, and reach their maximum earlier. The maximum height of army recruits falls between the twentieth and the twenty-second year, and is 170.5 centimetres. If in growing the body retained the proportions of the several parts, the weight of the adult would be twenty-seven times that of the new-born child, inasmuch as the adult is three times as tall as the babe, and the volume is as the cube of the height. As it is, the adult weight is only twelve times the original, and this difference shows how much more the growth is in height than in any other direction.

The usual method of obtaining these average results is to measure groups of children of certain ages, and take the mean result. Another method is to observe the same children, and measure and weigh them for many years. The latter is the more troublesome, but the inference from it is more immediate; though the former, when based on sufficiently large numbers, gives reliable results. Dr. Landsberger has been measuring a large number of children in Posen, Germany, and always the same children, since 1880, — a period of six years. The measurements have been made always between the 5th and the 15th of May, at the same time of day, in the same place, and with the same instruments. The average period covered is from the sixth to the thirteenth year. One curious result is, that the social factor as between the rich and the poor is a much more important one than the racial as between Poles and Germans. The rich children come to school taller and heavier than the poor ones, though their increase after getting to school is not more rapid. This long-lasting effect of early care is much more conclusively shown by the figures of another observer, Russow, who has tabulated the heights and weights of children from their second to their eighth year, distinguishing between those that were naturally suckled and those that were artificially reared, and throughout all this period shows a balance in height and weight in favor of the former.

Perhaps the most original investigation in this field is that of Dr. Malling-Hansen, director of the institute for the deaf-and-dumb at Copenhagen; the measurements being made on the children of that institution ranging from nine to fifteen years in age. The weights of these children show three marked periods in each year: there is a period of maximum growth in weight extending from August to the middle of December, a period of mean growth in weight from then to the first of April, followed by a period of minimum growth in weight back to August again. During the period of maximum growth in weight, the daily increase is three times as great as during the period of mean growth; and almost all that is gained in the latter period is lost in the period of minimum growth. With regard to height, these periods are equally evident though not coincident. In Copenhagen the period of minimum growth in height is from August to the end of November; the mean period, from then to March; and the maximum period, from March to August. In the maximum period the daily increase in height is two and a half times as great as in the mean period, and in the latter two and a half times as great as in the minimum period.

The period, then, at which the general increase of the body is going on is from the end of March to December; and within this period there is a period of maximum increase in height and a period of maximum increase in weight. During the period of most rapid increase in weight, the increase in height is the slowest of any in that period, the times of mean growth of height and weight about coincide, and the period of maximum growth in height is a period of comparative rest for the weight. The height-periods begin and end about fifteen days before the weight-periods. The height first has a period of minimum growth, then a period of mean growth, then its maximum growth, and then suddenly falls back again to the minimum rate of growth. The weight, however, begins with a minimum rate of growth, passes at once to its maximum, and then slowly falls through the period of mean growth back to the minimum again. The growth in weight varies more than the growth in height. An increase of 1 centimetre of height corresponds to 2.84 kilograms during the period of maximum growth in weight, but only to .48 of a kilogram in the period of mean or minimum growth. The increase of weight in the maximum period is essentially a growth in stoutness, and the loss of weight during the period of minimum growth is a decrease in stoutness. In the period of maximum increase in height the increase in stoutness is at a minimum, and during the period of least increase in height is at a maximum. A practical lesson to be derived from the knowledge of these periods is to have as large as possible a share of the period of general greatest growth fall into the vacation-time; for then the body has less strain upon it, and is in general in the best condition for growing. The Swedes and South Germans are accordingly right in giving their children two or two and a half months vacation, from July to the middle of September, thus including a good share of the greatest growth period.

Dr. Malling-Hansen has also attempted to make out shorter periods of twenty-five and seventy-five days of variations in growth, which he regards as due to the changes in the climatic conditions, but this is not as yet securely established. His study of the height reveals some very interesting points. It is well known that we are longer when we lie down than when we stand up, and this difference may be as much as a centimetre. So, too, after a long walk, when the weight of the body has compressed all those parts that furnish room for contraction, the height is smaller. Twenty-two boys, thirteen to sixteen years old, were measured at different times of day. During the hours of leisure, from 6 to 8 A.M., a boy lost, on the average, 4 millimetres in height; while resting on the school-bench, from 8 to 9 o'clock, he gained .3 of a millimetre; during the instruction, from 9 to 10, he loses 1 millimetre; during the recess, from 10 to 11, the loss in height was 3 millimetres for each boy; from 11 to 12 during school-hours the body expands by 2 millimetres, but in the next hour in school loses .4 of a millimetre; in the leisure time from 1 to 5 o'clock the body loses 3 millimetres. In general, from 6 A.M. to 5 P.M. there is a loss of 9 millimetres; from 5 to 9 P.M. there are variations; and from 9 P.M. to 6 A.M. there is a gain of 9 millimetres. These measurements were taken during the winter months. The daily variations in weight were also observed. From the end of the chief meal, at 2 P.M., until 9 o'clock, each boy loses .13 of a kilogram, and from 9 P.M. to 6 A.M. there was a loss of .57 of a kilogram: of this, .28 of a kilogram was due to perspiration and exhalations, and the rest to excretions. From 6 A.M. to 1 P.M. there was a gain of .11 of a kilogram, and dinner added .59 of a kilogram. It is very much to be hoped that the custom of taking a variety of this kind of measurements will become widespread, and systematic attempts be made to extend and collect such observations.

SCARLET-FEVER REPORT.[1] — IV.

S. H. DURGIN, M.D., Boston, Mass., health commissioner, reports that the law of Massachusetts requires reports of scarlet-fever to be made by both the attending physician and the householder. Boards of health should verify the diagnosis, and cause strict isolation and thorough disinfection to be practised. Dr. Durgin believes that isolation can best be carried out in hospitals. Inasmuch as these measures are often successful in preventing the spread of the fever in schools and families, he thinks they would be equally efficacious in preventing its spread in a community. He thinks the use of drugs to prevent well persons from contracting the disease to be nonsense.

Mary B. Moody, M.D., New Haven, Conn., relates the following incidents, which have come under her personal observation, as showing the communicability of scarlet-fever: 1. Two children received a call from a little playmate who was affected with scarlatina. The disease was so light that it was not recognized for some days. The exposed children suffered from the anginose variety, but did not come down for six weeks. They were very ill, and attacked within a few hours of each other. 2. A young physician, male, called upon a lady directly after attending a scarlet-fever case, and without ablutions or change of clothing. She had unmistakable scarlet-fever two weeks later. Dr. Moody believes that in hyposulphite of sodium we have an agent which will protect well persons from contracting the fever when exposed. She says, "Hyposulphite of sodium in solution has appeared in two cases, at least, which came under my observation, to have sufficient protective power to enable a sister to attend the funeral of a brother dead of the disease, and to enter his two-roomed house, which was infected by it. She went against protest into what seemed certain exposure, was sixteen years of age. All the other children of the family had it, four or five of them within two months of the first case. The late Dr. Thomas F. Rochester of Buffalo related to his classes in college instances he had personally known where contagion of scarlet-fever was carried in clothing. One lady wore a wrapper to assist in caring for the daughter of a friend where she was visiting, who was ill with scarlet-fever. When her visit was ended, she put the wrapper in her trunk and went to the house of another friend, who had a daughter about the same age of the one to whom she had recently ministered. There were no cases of scarlet-fever in the vicinity, nor had there been for a long time. She wore the wrapper soon after her arrival. In a few days the little girl sickened with scarlet-fever and died."

[1] Continued from *Science* of Jan. 13, 1888.

Fred. K. Smith, M.D., Calumet, Mich., says, "I have seen repeatedly successive cases, occurring in families at intervals of a few days or one or two weeks, where it has apparently been communicated from one to another. In one case which I observed, a young lady, having a mild attack in Michigan at a place where it was epidemic, went home to Ohio about two weeks after the beginning of the attack. Within two weeks after her return, her sister was attacked with the same disease, no other cases existing in the neighborhood at that time. The weight of evidence indicates that a scarlet-fever patient may communicate the disease to others for a period of six weeks from the beginning of the disease, and, if complete disinfection is not then accomplished, for an additional period from virus retained on the skin and clothing." Dr. Smith thinks that placards should be affixed to houses in which scarlet-fever exists, and that the occupants should not be permitted either to make or receive visits.

D. L. Phares, M.D., Agricultural and Mechanical College, Agricultural College P.O., Miss., narrates a case in which a gentleman spent about a week helping to nurse a case of scarlet-fever. When the patient died, he rode about twenty miles, taking his clothing with him, to spend some days with his sister and her children. In a few days the children took the disease, and part of them died. No other means could be discovered of taking the disease.

W. W. Daniells, Madison, Wis., reports the following case: "A lady nursed her sister's children in a house adjoining mine, and when she went home (after a thorough bath) wore no clothing that had been near the house where the sickness occurred; yet her own child, who had not been otherwise exposed, took the disease, the germs having been probably carried in the hair, which had not been cleansed."

Charles Schäffer, M.D., Philadelphia, Penn., reports the case of a young nephew of his, less than a year old, who contracted the disease in a house where a death had occurred three months before, and was supposed to have been disinfected. In another instance two children of a friend died from the disease after returning to their home several weeks after the recovery of another member of the family from the fever.

Charles N. Chapin, Providence, R.I., superintendent of health, makes the following statement as showing the practice of the health department in that city: "At present we placard houses; exclude children of household from school, Sunday school, etc.; distribute circulars of information; forbid public funerals; and fumigate with sulphur. We should, in addition, fumigate all textile fabrics, etc., with steam, and have a hospital for the treatment of those cases which cannot be isolated at home. Our rules are fairly well complied with; and it is possible, that, if they could have been strictly enforced at the beginning of this epidemic in August, it might have been stopped. But I do not feel at all sure but that the only way to prevent the spread of this disease is to remove every case to a hospital, or else put a guard around every infected house, and prevent every possible contact with the community. I shall be pleased to give you the results of our efforts later in the season, whether they are favorable or not. Thus far the cases reported per week have been as follows: —

	August.				September.				October.				
Date	6	13	20	27	3	10	17	24	1	8	15	22	29
Cases	0	4	4	7	9	3	8	33	49	58	56	37	34

"Reports of cases should be made by physicians, because they are cognizant of the majority of cases, and because they can recognize the disease. Physicians should be licensed by State boards of health. The physicians should be paid for this service by the local government. When a physician is not employed (and perhaps in all cases), the head of the household should be obliged to report. This is the law in this State. But it is by the rules of the board of health in this city that the reporting by physicians is made compulsory. They are not, however, paid for this service. About ninety per cent of all cases are reported by physicians. We learn of the others through the assistance of school-teachers chiefly. Probably very few cases now escape us."

John M. Scudder, M.D., Cincinnati, O., believes that scarlet-fever may be communicated by milk. He has traced one such instance, where the milkman's children had the fever, and it was communicated to customers at the isolated points. He thinks this, however, is rare. Dr. Scudder further adds, "I had one case in which the disease was communicated five months after recovery, by playing with dolls and toys which had been locked in a drawer during that time. In another case, in the family of Mr. ———, the time was eleven months. There could be no mistake in either case. In another case the circumstances pointed to a contagion fourteen months old." He thinks that boards of health should distinctly mark each house 'Scarlet-fever Within.'

A. P. Richardson, M.D., Walpole, N.H., sends the following case, which came under his observation: "A child had scarlet-fever in Keene, N.H., and late in the stage of desquamation visited a friend in Walpole, N.H., slept with a child who died of malignant scarlet-fever a few days after, being sick only a few hours." He adds, "I remember the mother of a child which had died of scarlet-fever sent some of the deceased's playthings to a child in another family, the latter being sick with the disease soon after."

W. S. Strode, M.D., Bernadotte, Ill., writes, "In March, 1884, scarlet-fever was brought to Bernadotte by a family (resident) visiting another family six miles distant, in which a small child had just taken sick, said sickness being accompanied by a red rash. A little boy four years old of the above family, after a few days, took sick, the sickness being accompanied by a rash, not very prominent, and died in twenty-four hours from the time of the first symptoms. The physician diagnosed the case as diphtheria, and a number of children were permitted to see the corpse and attend the funeral. Two or three days later, the remaining children (two younger) took sick with the same symptoms, and I was sent for, and at once proclaimed it scarlet-fever, and immediately set about to guard against its spread by having the school stopped, and all families that had been exposed isolated. There were nineteen cases that broke out with the disease, all in families that had been exposed to the first case. No more deaths, and not all the children in some of the families contracted it either, though exposed to it for days. I would say, that, at the time of the above epidemic, my family consisted of four children, aged respectively one, six, nine, and twelve years. I took ordinary precautions, after visiting the families infected, to guard against carrying to my own family or that of others, by changing my outside apparel at my office, washing, etc., and by going about in the open air for some time. My children did not become infected. Three weeks later, that is, after all the cases had recovered, it was again brought to town by a visiting family; this family unknowingly being exposed to scarlet-fever on the train, and two children breaking out with it in two or three days after they arrived. But previous to this time the lady that the mother of the children was visiting put on her shawl, and came to my house, and, without removing her shawl, took my baby in her arms and held him for some time. In four days he broke out with a typical scarlet-fever rash; and in from four to seven days from this time the three older children of my family also broke out with it. The three children of this lady also had it, making nine additional cases. All recovered. By a strict quarantine the contagion did not spread any further."

G. P. Conn, M.D., Concord, N.H., member of the State Board of Health, says, "In reply to your inquiries, allow me to say that over thirty years of dealing with scarlet-fever and kindred disorders has not convinced me that I know all about its origin or its development. On the contrary, I am constrained to add that I fear we have not solved the problem, nor are we likely to do so at present unless by accident. I have found so many instances where it could not be traced, and in other cases where one in a large family of children would have the disease while all others would escape, that I feel that my knowledge is hardly worth repeating. I do believe that there is a vast difference in the degree of cases, and that in some instances it arrives at a development where none unprotected will escape, while in other cases none will be made ill except the more susceptible. Unfortunately, the profession are not yet able to determine to which class a given case belongs, and therefore it is necessary to carefully isolate all in order to be sure."

George J. Engelmann, M.D., St. Louis, Mo., relates the following striking cases: "Mr. H., living in Belleville, Ill., had a child sick with scarlet-fever, bade the child good-by, drove fourteen miles in an open buggy to a farm, shook hands twice with a young lady there, and took dinner with the family. He saw no more of the young lady, but was busy outside with the father during his visit. There was no scarlet-fever in the neighborhood of this farm, yet that young lady, twenty-one years old, the youngest in the house, took the scarlet-fever, infected by Mr. H. The clothing of children who died from scarlet-fever in Denver was taken to the house of Dr. R. in St. Louis, after having been put away in camphor for the winter, and gave scarlet-fever to all of Dr. R's children eight months after the decease of the children in Denver."

H. Hartshorne, M.D., Philadelphia, Penn., reports, "I know of no valid reason for believing that scarlet-fever ever arises, at the present time, except by contagion from a pre-existing case. I have no doubt whatever of the contagiousness of scarlet-fever; although, as in the case of other communicable diseases, some persons exposed may escape being affected by it. Having withdrawn from the active practice of medicine, I cannot give precise details of such cases coming under my personal observation; but they have been amply sufficient to confirm me in a strong conviction on the subject. When a person who has had scarlet-fever ceases to communicate it, must depend partly on the measures taken — by repeated bathing, change of clothing, etc., after recovery — to remove all remnants of the eruption. When such care is taken, thirty days from the beginning of the attack ought to suffice. With average care, it had better be made forty days. I have had direct information of several instances in which a house, not disinfected after scarlet-fever had been in it, gave evidence of infection remaining in it several months after the recovery of the patient so affected in it. I believe (from the above-mentioned reliable information), that, without disinfection, rooms are more liable to the retention of the contagion of scarlet-fever than persons who have had the disease. In populous cities the dissemination of scarlet-fever is apt to be so wide, and the means of communication so unavoidable, that no benefit is likely to result from requiring cases of it to be reported by physicians or others to boards of health. Boards of health, if such reports are received, should advise the sequestration of the patients as far as practicable, especially from other children, and, on their recovery, should insist on thorough disinfection. The spread of scarlet-fever could be diminished, at least, very much, by isolation of patients during the attack, disinfection of bedding, clothing, and rooms, etc., on recovery, and all measures of sanitary improvement (in cleanliness, ventilation, etc.) which lessen the prevalence and mortality of *all* contagious, infectious, and epidemic diseases. I doubt very much whether any thing can be done, by the use of remedies or otherwise, to prevent well persons from contracting scarlet-fever when they are exposed to it. It is *a priori* improbable, though not impossible. When a medical student, residing in a house in which there was scarlet-fever, I took belladonna for several days, and escaped the attack; and I have known another instance of the coincidence of the use of belladonna with escape or exposure. But the contagion of scarlet-fever is more uncertain as to individuals, than that of measles or small-pox; that is, a greater number of those exposed to it may escape it than either of them."

THE TEACHING OF DRAWING.

IN a paper on the teaching of drawing, read before the College of Preceptors by T. R. Ablett, Esq., and reported at some length in the *Educational Times*, the educational value of the subject is brought out with a strength and clearness that render the paper of more than usual interest to our educators. Mr. Ablett considered drawing simply as a means of education, and explicitly set aside any treatment of it as an accomplishment or as a training for artists. He pointed out that the mode of instruction in drawing, taken in this sense, would naturally differ from that followed when the production of artists was aimed at, and must be adapted to school-children most of whom have no special aptitude, and little time for practice. To raise drawing to its proper position, we must prove that it is one of the bases of education, and should be taught to all children, whatever their future vocation. We must also prove that it can be taught by collective methods as readily as arithmetic or reading. The speaker then summarized the educational advantages of drawing, as follows: I. It brings into active use certain faculties and powers of the mind, which can be reached to an equal extent in no other way. For example: correct ideas of proportion and scales are developed, the graphic memory is improved, accuracy in observing is promoted, the powers of description are increased. Although drawing is a universal language, yet few are able to use it. II. Drawing facilitates the acquirement of the simple elements of education. For example: spelling demands a power of remembering the look of words, since in English the sound is not always a trustworthy guide. The improvement of the graphic memory will aid in learning to spell. Again: a child may be taught to draw before it is possible or desirable that he should learn to write. The pen is the worst of drawing-tools, and should not be the first to be put into the hands of children. The earlier use of simpler drawing instruments will facilitate learning to write. Again: drawing teaches the arithmetic of space, as figuring teaches the arithmetic of numbers. There is no reason why the child should be taught one and not the other. The arithmetic of space may be taught as soon as a child can use a ruler and can understand something of drawing to scale. Furthermore, facts which in figures make no appeal to the mind can be readily grasped by means of drawing, especially if these are made by the pupils themselves. In all these ways drawing actually improves the mind's capacity for learning other subjects.

As a rule, the teaching of drawing is in a very backward state; for art teachers, so called, as a rule are poor teachers, and the whole instruction in this branch has been hampered by the prevalent belief that no one should learn drawing who has not a special talent for it. Then, too, collective methods of teaching have not been properly developed. To accomplish the last-named object, it is essential that the members of the class be so arranged that each one can have approximately the same view of the object to be drawn. Object-drawing is the most difficult branch of the subject to be taught collectively, but it can be done. For good class-teaching of object-drawing, three vital principles must be observed: (*a*) the object must be a large one, that all can easily see; (*b*) all members of the class must obtain approximately the same view of the object; (*c*) the teacher must be acquainted with class management and with the subject, and able to demonstrate principles and methods with ability and enthusiasm.

Mr. Ablett then presented the pedagogic aim of drawing in the different grades. In Class 1 it is, (1) to develop accurate observation, (2) to connect writing and drawing, (3) to ward off color-blindness, (4) to cultivate the perceptions, (5) to teach outline-drawing from real objects which present no difficulties in foreshortening; in Class 2, (1) to call attention to the difference between the real and apparent forms of simple objects and curves, (2) to cultivate the graphic memory, (3) by the dictated drawing to insure a knowledge of art terms and give facility in working from verbal instructions; in Class 3, to teach the leading principles of drawing in outline from the things of every-day life; in Class 4, to develop a useful power in drawing from rounded objects (plants and casts) that will serve as a stepping-stone between drawing from simple objects and drawing from the antique; in Class 5, to give a knowledge of shading from real things (this will assist the pupil materially in acquiring the principles of painting, should he ever want to do so); in Class 6, to enable those who have passed through the preceding classes to begin the study of the higher branches of art.

From the character of the discussion that followed Mr. Ablett's excellent paper, it is easy to see that the English schoolmasters are far behind our own, so far as understanding and appreciating drawing are concerned.

CASE SCHOOL OF APPLIED SCIENCE.

LEONARD CASE, the founder of Case School of Applied Science, was one of the few wealthy men who continue in after-life the literary and scientific work begun in college. Inheriting a large estate, he was relieved from the necessity of turning his acquirements to account in making a living, but he was nevertheless a lifelong student. He was one of a group of young men, who, under the leadership of the famous Dr. Kirtland, formed the Cleveland Natural History Society, and accomplished such excellent work, as is shown by their publications, and by the large collections now in the rooms of the society.

In general literature he was a careful student, and he was a writer of marked ability. His natural tastes, however, led him to give most attention to mathematics and natural science.

Prizing education and culture, he determined to do what he could for their advancement. His first gift to Cleveland, in pursuance of this idea, was Case Library, — a splendidly equipped and endowed institution, and, by the courtesy of its trustees, a valuable adjunct to the School of Applied Science. The magnitude of this public benefaction was, however, far surpassed by his later and more munificent gift for the school.

His deep interest in his favorite studies led him to desire that others should have an opportunity to pursue them under even more favorable conditions than he himself had enjoyed, and to that end he determined to found and endow a scientific school of high grade.

On Feb. 24, 1876, he executed a trust deed, setting apart certain lands to endow a scientific school in the city of Cleveland. In the trust deed he directed the trustee, Henry G. Abbey, "to cause to be formed and regularly incorporated under the laws of Ohio, an institution of learning, to be called the 'Case School of Applied Science,' and located in said city of Cleveland, in which shall be taught, by competent professors and teachers, mathematics, physics, engineering (mechanical and civil), chemistry, economic geology, mining and metallurgy, natural history, drawing, and modern languages. . . . And without intending to make it a condition or limitation of this conveyance, or any binding restriction upon the power of such trustees, the said grantor does hereby recommend to them to hold said property without alienation, and apply the rents, issues, and profits thereof to the uses and purposes above, and that the expenditures for such institution be not permitted to exceed the annual income derived from said property."

The value of the property thus dedicated to the cause of scientific education was about a million and a half dollars. It consists of real estate, a considerable part of which is centrally located in the city. One parcel is the City Hall Block, including both the building and the land; another is an entire block of land cornering on the City Square; and still others, of blocks of land less centrally located. The trustees have followed the recommendation of the donor, and have adopted the policy of leasing the land, so that a secure and increasing income to the school is assured.

After the death of Mr. Case, Jan. 6, 1880, the school was incorporated, and in 1881 instruction was begun in the old Case homestead near the City Square. The addition of new departments of instruction, and the rapid accumulation of apparatus and appliances for the laboratories and class-rooms, soon rendered more ample accommodations necessary. An admirable site was procured for the school on Euclid Avenue, opposite Wade Park; a commodious building was erected from designs by John Eisenman; and in the fall of 1885 the school took possession of its new quarters.

On Wednesday, Oct. 27, 1886, the new building and all of the valuable collections it contained were destroyed by fire. The trustees and faculty of Adelbert College generously offered rooms for the use of the school in a dormitory building standing very near Case School, and recitations and lectures were resumed on the following Monday, work having been suspended but three days. A temporary laboratory was erected for immediate use, instruments and apparatus were procured for the class-rooms and laboratories, and the work of the classes proceeded with comparatively little interruption.

The school is greatly indebted to the well-known mechanicians, Warner & Swasey, the Brush Electric Light Co., and several citizens of Cleveland, for valuable assistance in refitting the laboratories, and in replacing the library and the collections in geology, mineralogy, etc.

Meanwhile the reconstruction of the burned building was pushed as rapidly as possible. The trustees, with characteristic Western energy, ordered its reconstruction before the fire was entirely extinguished, and the contractor began work while some of the stones were still too hot to handle.

The building, as left by the fire, consisted of bare walls, badly broken, with some of the dormers and gables still standing in a damaged condition. Upon inspection it was found necessary to take down all above the main cornice, and about half of the walls. The material of the walls below the cornice was found to be in such good condition that all of this work was replaced according to the original design, except the tower. The entrance to the tower, not being badly damaged, was taken down, and replaced with only a slight alteration in the roof. The tower and every thing above the plancier of the main cornice are of different design from the corresponding parts of the original building. Before any new work proceeded, the board of trustees, in connection with their architect, Clarence O. Arey, discussed each point, so as to obviate as far as possible the defects that had been found in the former building.

The outside walls of the building are a combination of rock-faced ashlar and brick backing, except in the dormers, which are of solid stone. The stone used is Amherst, O., sandstone. All of the partition walls are of brick. The floors were formerly of wood, but are now to be thoroughly fire-proof, — of iron girders and tile arches. The roof was formerly of light timbers close together. Now it is built of heavy timber, according to the 'slow-burning' method of construction, and is slated with Maine slate. The flashings and gutters are all of copper. The ridge-rolls, and front and under faces of the upper mouldings of the cornice, are of galvanized iron. This is used only where it is easily replaced or very little exposed. The tower is now temporarily roofed with a flat, pitched roof at the top of the stone-work, and only part of the carving shown in the drawing is completed.

A general view of the reconstructed building is shown in the accompanying illustration. It has a ground plan 161 by 92 feet, and

consists of three stories besides the basement and attic. The basement is arranged for heavy machinery, laboratories, and workshops. The remainder of the building is designed for class-rooms, drawing-rooms, and cabinets for collections, etc. The boiler-room is outside of the walls of the building, to avoid danger from fire or explosion. The chemical laboratory, which also contains the furnaces for assaying, is in a separate building. Every precaution has been taken not only to render the building fire-proof, but to keep fire entirely out of it.

The educational interests of the school have been carefully attended to. The school is well organized, and is supplied with a strong corps of professors.

The preparation required for admission is such as is given by the best high schools and academies. The studies pursued in the school consist principally of modern languages, mathematics, natural history, natural science, and engineering. The school provides courses leading to the degree of bachelor of science (B.S.) in civil engineering, mechanical engineering, mining engineering, electrical engineering, physics, and chemistry. While advanced theory occupies an important place in all of the courses, the methods of instruction incline decidedly towards the practical. Laboratory, shop, and field work are prominent features of the various courses.

Original investigations both by professors and students are constantly in progress in the various departments, and some of the published results are valuable contributions to the advancement of science. Just at the present time scientific men are deeply interested in some investigations now in progress in the school, preliminary statements in regard to which have already been published.

The city of Cleveland affords unusual advantages for a scientific school. It is an important railroad centre and lake port, and offers excellent opportunities for studying the various engineering problems connected with transportation. It is the centre of extensive mining and manufacturing interests. It has chemical works, steel-works, rolling-mills, furnaces, forges, machine-shops, and manufactories of electric machines and appliances, and of various other sorts. These, in many cases, are the most extensive of their kind in this country, and their variety is noteworthy. Almost all varieties of engineering structures and of manufacturing processes can be seen in the city, and are available for examination and study by the students. These advantages, and their influence in insuring the prosperity and usefulness of the school, were fully appreciated by Mr. Case, and had no slight weight in influencing him to found the school.

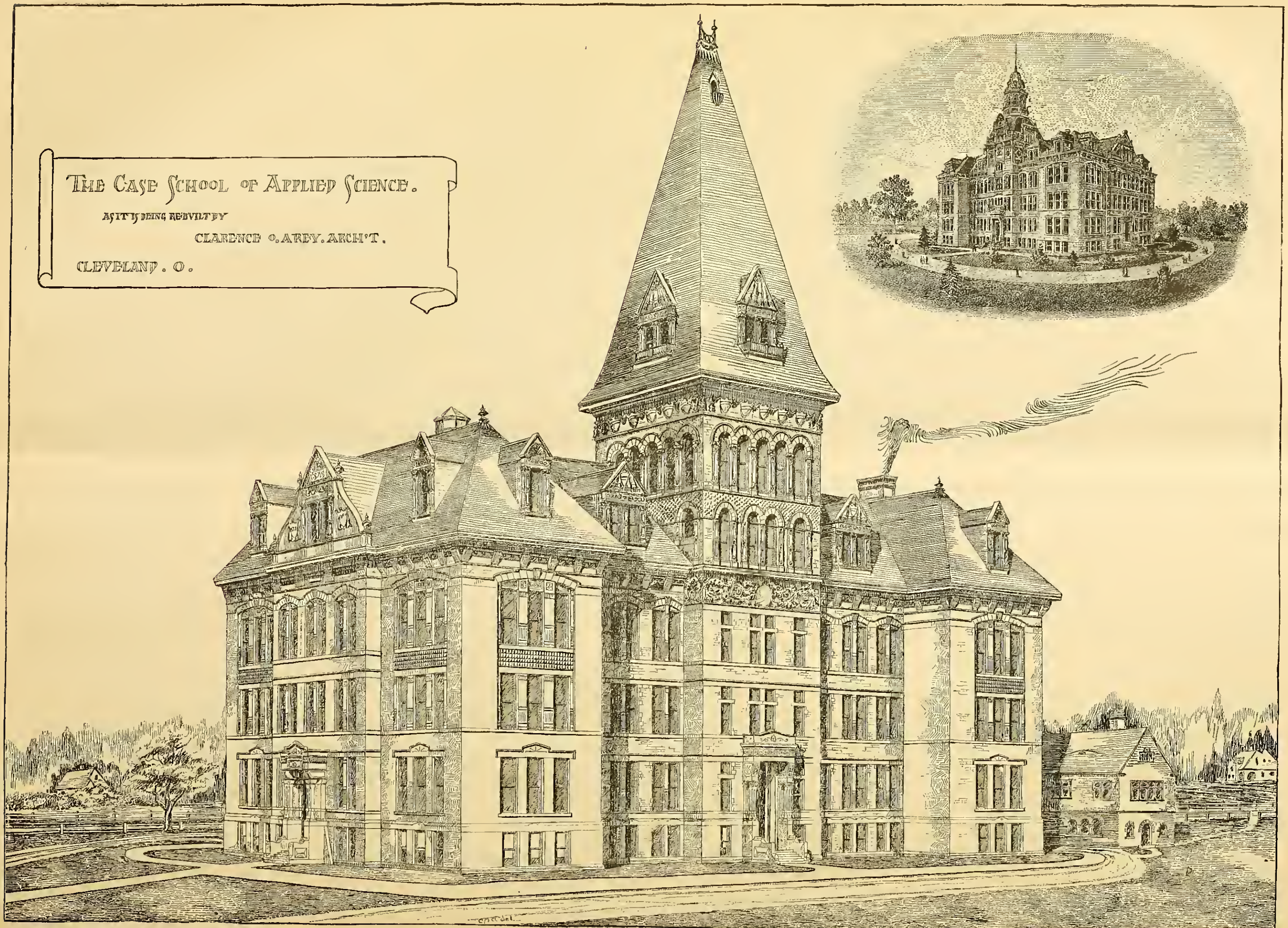
ETHNOLOGY.

Prehistoric Researches in South-eastern Spain.

TWO Belgian engineers, Messrs. Siret, are about to publish the important results of their extensive archæological researches in Spain, which extend over the coast from Carthagena to Almeria. The oldest remains belong to the neolithic period. There is not a trace of metal to be found in these ancient habitations. The implements consist of polished axes, perforated shells, pottery, grinding-stones, chipped flints, and primitive walls of stone. In another class of sites which belong to a more recent period, remains of copper and a few bronze implements were found. The inhabitants lived in stone houses, the stones being cemented by earth. Flint implements, particularly arrow-heads and knives, ornamented pots, bone points, and numerous copper celts, were found in the houses. Cremation was practised to a considerable extent by the people of that period. Copper ores and scoriæ proved that they practised the art of smelting.

In a later period fortified villages, with walls made of stone and mud, were built on the tops of the hills. In the space surrounded by the walls, the ruins of burnt houses, implements, remains of grain which was kept in clay pots, cloth made of broom, and hand-mills, were found. Flint was used only for making saws. The dead were buried in natural caves, or in stone boxes under the houses or near them.

At the end of the copper period the inhabitants still lived on the tops of steep hills, in fortresses. The implements consisted of the same material, but, besides, moulds for casting copper, ivory, gold, and silver were found. Over twelve hundred graves belonging to this period were opened. All of them were situated in the houses, and consisted either of small chambers of stone, of stone boxes, or of huge clay pots with rounded bottom and wide mouth. The largest of these are over three feet long and two feet wide. The skeletons are doubled up, hands and knees being pressed against the chin. Sometimes husband and wife are found in the same urn. The study of this vast amount of material will be highly interesting.


THE CASE SCHOOL OF APPLIED SCIENCE.
AS IT IS BEING REBUILT BY
CLARENCE O. AREY. ARCH'T.
CLEVELAND. O.

Virchow points out that part of this ancient culture is probably due to Phœnician influence (*Zeitschr. für Ethnologie*, 1887, No. v.).

PREHISTORIC SKATING. — As is well known, the art of skating is a prehistoric one. In many parts of Europe bones of domesticated animals have been found which had been used as skates or as runners of small sledges. It is of considerable interest to learn that similar implements are found still in use in several parts of northern Germany. In the *Journal of the Berlin Ethnological Society*, sledges are described which consist of a board resting on the bones of a horse. But, besides this, skates are used the runners of which consist of the lower jaw of cattle, the curvature of the lower side serving admirably the object of the skate.

BOOK-REVIEWS.

The Early History of the English Woolen Industry. By W. J. ASHLEY, M.A. Baltimore, American Economic Association.

"I CANNOT but be sensible," says the author, "of the honor which the American Economic Association has done me by permitting me to join in their work." The members of the association might say in reply, that they are sensible of the honor which Mr. Ashley has done them in consenting to take part in their work. The co-operation of English and American students in economics is most encouraging; at least, we on this side of the water appreciate very highly such papers as the one which forms the subject of this notice, or as lately appeared in the *Quarterly Journal of Economics* from the pen of Professor Foxwell of Cambridge.

There are two points of interest in the preface to this monograph. In the first place, Mr. Ashley explains, very properly we think, the revival of economic studies in the United States. This country, he says, "exhibits the forces of competition and capital working on a larger scale than elsewhere, and in a freer field, uncrossed by any of the influences of decaying feudalism." England is no longer "the classic land of capitalistic production," as Karl Marx once called her: that honor now belongs to the United States. It is, then, chiefly because economic questions have lately come to be of such importance, that Americans are studying them with earnestness; and it is because the field offered for their solution is comparatively free that European peoples regard that study with peculiar interest. But, in the second place, our author cautions American students against being too greatly influenced by the teachings of German universities. "No observer of German thought," he says, "can fail to see, that, though most vigorous within its range, its range is exceedingly narrow. German writers seldom realize the atmosphere of individual initiative in which English and American thought moves." And he adds, "American teachers will be compelled, by the traditions of their country, the needs of their pupils, and the criticisms of their opponents, to give due weight to the forces of competition and to the arguments of more recent English economists." This view is certainly correct. There is a radical difference between the German and the American. Whether we consider political or industrial affairs, the closer we observe, the more strongly do differences impress themselves upon our minds. German thought does not fit American affairs. The only lesson of abiding importance brought from the universities on the continent pertains to methods of investigation.

Turning now to the monograph itself, we find it to be an eminently satisfactory sketch of the history of the English woollen industry from earliest times to the period of the great inventions. The peculiar interest in such a sketch lies in the fact that the history of the woollen industry fairly represents the development of all industries. Whether we consider the relation of artisans to early local government, or the internal organization of trades, or the social and political influence of changed methods of doing work, we find a true picture in the history of the woollen industry. The author divides his sketch into four parts. He first treats of the establishment of the guild system; second, of the education of the English workman by the importation of foreign skilled workers; third, of the rise of the merchant class; and, fourth, of the growth of the domestic system. For us in this country the part which treats of the separation of the merchant class from the main body of workers is perhaps the most instructive. Americans pride themselves on being cosmopolitan, and it is true that their love of travel makes them familiar with the existing habits and customs of many peoples; but when it comes to history, their minds are essentially provincial. They are prone to regard the nineteenth century, out of which their minds have never travelled, as the natural and therefore the permanent order of society. Their conservatism is, on this account, unreasonably strong. It would be a good thing if every business-man could be brought to see that there once existed a successful industrial society, in which a separate class of traders was not known. They then might regard with less suspicion certain tendencies in modern times looking towards further industrial changes.

But professed students of history, as well as business-men, will find in this monograph much instruction. It is a common error to say that machinery and steam-power are responsible for the creation of a clearly defined laboring-class. Mr. Ashley shows that such an assumption is not correct. His sketch closes with the establishment of the 'domestic system' of industry, but the liberties and rights then exercised were very nearly the same as those which laborers now enjoy. It needed only the great inventions to fully establish the 'factory system' as we now know it, and to bring about the era of great industries. Failure to recognize that the social position of the workman was quite the same before and after 1760 is responsible for many misinterpretations of industrial history.

In closing we can only say that American students are always grateful for reliable information on English industrial history. They feel that the society with which they deal is as much the result of English life during the middle ages as is English society itself. But this they cannot study at first-hand, because of paucity of material, and on that account they read with eagerness all that English scholars may write upon the subject. Mr. Ashley, then, has the thanks of American students for his excellent monograph on the English woollen industry. H. C. ADAMS.

A Plea for the Training of the Hand. By D. C. GILMAN, LL.D.

Manual Training and the Public School. By H. H. BELFIELD, Ph.D. New York, Industrial Education Association. 8°.

Primary Methods. By W. N. HAILMANN, A.M. New York, Barnes. 12°.

Industrial Instruction. By ROBERT SEIDEL. Tr. by Margaret K. Smith. Boston, Heath. 12°.

The Manual-Training School. By C. M. WOODWARD, Ph.D. Boston, Heath. 8°.

EACH one of these books bears evidence in its own way to the educational *Zeitgeist*. Each one, had it appeared ten years ago, would have appealed to perhaps a few score readers: it is safe to say that at this time they will be read by thousands. Educational thought and educational practice are in motion. In all parts of the country and in all grades of schools the signs of progress are seen and its effects are felt. The dominant trait of this progress is a demand for reality in education, for practicality in the widest and best sense of the word. Teach the child to know not merely words, but things, objects; teach him not merely to know, but to use and apply what he knows. Teach him literature, teach him arithmetic, teach him geography, and so on, but also teach him something about the busy, active life of which he is so soon to form a part. Teach him not only to perceive and to remember, but to compare, to judge, to execute, to manage. This, if its opponents did but know it, is the philosophy of manual training; and because this philosophy is so certain and so sound, the manual-training movement is carrying every thing before it. The best educational thought of the country is enlisted in its service; and its advocates are making rapid and successful progress, while its handful of vociferous opponents are asserting that it is useless, crude, and destructive of the school. The success of manual training, and the thought and inquiry it has aroused, call for a literature. All of the books whose titles are given above are in answer to this call.

The first is a handsomely printed pamphlet, the first of a permanent series of educational monographs to be issued under the editorship of the president of the Industrial Education Association of

New York. That association is the recognized centre of the manual-training movement, and in these monographs we may expect to find some able expositions not only of manual training, but of other educational subjects. We notice that Sir Philip Magnus of London, Professor Paulsen of Berlin, Professor Sluys of Brussels, Dr. Hannsk of Vienna, Professor Salicis of Paris, Oscar Browning of Cambridge, Colonel Parker of Chicago, Dr. Channing of Harvard, Superintendent Mac Alister of Philadelphia, Dr. A. G. Haygood of Georgia, and Dr. Wey of Elmira, are on the announced list of contributors; and we await from their pens some of the best educational writing, in a convenient and inexpensive form, that has ever been printed in this country.

The present issue is a double number, and the two papers complement each other. President Gilman writes in an easy, graceful way of the training of the hand, and puts his argument so simply that the veriest novice in educational matters should be able to understand it. His summary of the principles of manual training (pp. 11–13) is very comprehensive, as is the following concise summary of the whole question: "Manual training is an essential part of a good education, whether that education be restricted to the common school or carried on to the highest discipline of technical schools and universities" (p. 13).

Dr. Belfield of Chicago, whose paper forms the second part of the number, makes a powerful argument on the practical side, for the introduction of manual training into the common school. He is able to show from his own experience that better progress is made in other studies with manual training than without it. This is the natural result of the intellectual tonic administered by manual training, as well as of its harmonious development of all the faculties. For the student or teacher who is making a study of manual training, this first number of the Educational Monograph Series is the best possible introduction to the subject.

Dr. Hailmann is a gentleman who has written much, and on the whole well, on education. He is a student and translator of Froebel, and a firm believer in kindergarten methods. In his preface he expressly states that the present work is issued in response to the growing demand among primary teachers for 'busy work' and 'kindergarten methods.' The book is eminently practical, and, so far as it goes, gives an excellent manual-training course for the primary school. We will only say that clay can be used more than the author provides for, and that drawing is the very foundation of manual training. The latter fact seems to have escaped Mr. Hailmann's attention while he was engaged on this book.

'Industrial Instruction' is a translation from the German of Robert Seidel, by Miss Smith of Oswego Normal School. It is a philosophical treatise on manual training, and yet it is sufficiently easy of comprehension to be of assistance to all teachers. An unfortunate disjointedness of style, the usual attribute of German writing, mars the book, but the translator seems to have worked hard to counteract the effect of this. The second chapter, which is entitled 'Errors, Contradictions, and Inconsistencies of the Opponents of Industrial Instruction,' is respectfully commended to the attention of the secretary of the Massachusetts Board of Education and the superintendent of schools at Worcester, Mass.; for both of these gentlemen are not only utterly in the dark about manual training, but they are using their influence on the platform and in educational journals to keep others in the same condition. Seidel shows that the sort of industrial instruction which such persons declaim against has for its aim "principally the development of certain kinds of manual skill, partly by this means to promote domestic industry, partly to prepare for a later profession, to supply trained strength to hand-labor, and thus to elevate it." All sane men who know any thing of public schools unite in insisting that instruction of this sort must not be permitted to find a place. But this instruction is diametrically opposed to that which the advocates and expounders of manual training are upholding. Their manual training is educational, not technical: it develops the judgment and reason, not the power of imitation. Inasmuch as the opponents of manual training in this country seem to be unable to distinguish it from technical instruction, we hope that they will read Seidel's book. Every possible confusion that they can fall into is there explained, and every possible objection that they can raise is there answered.

Dr. Woodward's book is not so satisfactory, but it has a value of its own. It deals with the manual-training school only, considered as a separate institution. This it discusses in full detail, and the theory and practice of the work done at St. Louis are clearly presented. Much of the information as to cost and character of equipment is that which is frequently called for at this time by the school authorities of cities where manual training is being introduced. Almost half the book, however, is given up to Dr. Woodward's various addresses, some of them delivered fifteen years ago. No attempt seems to have been made at editing them, or striking out redundancies and inconsistencies. However forcible they may have been when delivered, they lose much in the present arrangement.

We would close as we began. All of these books are valuable and suggestive. All of them should be widely read, especially by teachers and by parents who have children to educate. All of them approach manual training in the right spirit and with intelligence. The insight of the authors is sufficient to guard against any such ludicrous presentation as that given by Mr. Love in his 'Industrial Education,' a book which we had occasion to notice a few months ago (*Science*, x. No. 247). Taken together, they would form an excellent beginning for a library on manual training.

La Psychologie Physiologique. Par G. SERGI. From the Italian by M. MOUTON. Paris, Felix Alcan, 1888. 8°.

THE flourishing condition of science in Italy has of late been the subject of frequent remark. The universities have filled their chairs with a new generation of men, well schooled in the best methods that the continent can offer, full of enthusiasm for their special pursuit, and gifted with a taste for original research as well as with a comprehensive appreciativeness for the work of others. As the result, there have been appearing from the press of Italy many very valuable contributions to all departments of science, and, what is especially noteworthy, publications tracing distinct novel lines of thought. This has made all scientists look more carefully into the Italian periodicals; has set Frenchmen, Germans, and Englishmen to translating their books; and promises to make a knowledge of Italian quite as requisite a possession for the scientist as a knowledge of French and German.

In the scientific study of mental phenomena the Italians stand in the foremost ranks. They have developed a school of criminal anthropology, setting forth the true nature of the criminal as an aberrant form of humanity, that has gained a world-wide recognition. Their studies of the insane are full of ingenious methods and suggestive results. Some of the best work on the localization of function in the brain has been done in Italy. It is, then, not surprising that they see in experimental psychology the completion of the circle of the sciences, and do all in their power to develop and spread its teachings. Nothing could better illustrate the truly admirable character of their work than this manual of psychology. The author is professor of anthropology in the University of Rome, but his conception of anthropology is broad enough to include an intense interest in all that pertains to the human mind. The volume is written in an entirely modern spirit, and is quite different from the type of text-book that prevails in our colleges.

Perhaps no easier method of indicating the character of its contents could be pursued than that of *résuméing* the table of contents. It begins with a terse description of the physiological elements of which the body is composed, with a special description of nerve cells and fibres. Then follows a chapter on the objects of psychology, showing its very intimate connection with physiology and the insensitiveness with which the unconscious shades into consciousness. There is no attempt at abstract, pure distinctions, but a straightforward account is given of what it is that a student of psychology must know and be interested in. Then sensation is treated, and covers nearly a hundred pages. After a general consideration of what sensibility implies, follows a more than usually good and full account of the facts summed up by the psychophysic law. Then the special senses are treated, though not at as great a length as might be desired; a surprisingly large amount of information, however, is expressed in a very few pages. This section is concluded by an interesting chapter on the interpretation of sensations. The next part of the book deals with the intellect, and begins with a description of its anatomical basis. Then follows the portion most similar to current text-books of psychology upon reasoning and ideas, but treated with a scientific appreciation of its import not too frequently met with. A very detailed analysis of the theories attempting to explain the perception of space and time concludes this portion of the book. The third portion of the book gives a convenient account of the facts of consciousness, the laws of the association and reproduction of perceptions, a clear account of the experiments upon the time occupied by the simpler psychic acts, and of the phenomena of unconscious mental action. The fourth part deals with the feelings, and is perhaps too long in proportion to the rest of the work. Here the anthropologist speaks out most strongly, and much matter is inserted not usually considered of prime importance in a text-book. The division of topics is into the individual, the individuo-social, the social, and the æsthetic sentiments. The final portion of the book is devoted to the will, and gives a good though brief description of the various kinds of movements, of the expression of the emotions, of the development of will, and discusses from a psychological point of view the problems of free will and of responsibility.

It will be seen that the order of topics is somewhat unusual, but the merit of it can be tested only by actual trial as a text-book. The especial merits of the work consist in the brevity of its statements; in the complete absorption of the scientific method of viewing mental facts, and thus avoiding the fault most common in American psychological text-books of introducing the facts of experimental research, but leaving the whole topic unenlivened by a rejuvenating scientific interest; and in the skill and care of its presentation.

The Italian edition of the work was published in 1879, and, though the French edition has been revised, it has not derived the full benefit of the most recent studies, though this is in many cases no serious omission for a work of this kind. The object of writing the book, the author tells us, was to spread the knowledge of the modern methods of psychological research in Italy. If the students of the Italian colleges can use such a text-book as this intelligently, they must have a sounder scientific training than can be expected from the ordinary junior or senior of American colleges. This is the most serious fault of the book; or it would be, at least, for an English book of the kind. Its brevity has made it technical, and the uncertain character of several of the topics most fully treated requires a well-trained student, under the care of a skilful teacher, to insure its appreciation. Having in view the text-books more or less devoted to the exposition of a scientific psychology, recently published, it can, without hesitation, be said, that for the best selected information, most conveniently and pedagogically expressed, no better four hundred and fifty pages can be found than those of Professor Sergi's book.

NOTES AND NEWS.

FOR a number of years the deficiency in the production of mulberry-silk has drawn the attention of sericulturists to the rearing of the wild silkworms of India, China, Japan, America, and other parts; and a great many reports have been published on these wild silkworms, some of which are already bred in a state of domesticity or semi-domesticity. Reports on this subject have appeared during a succession of years in the *Journal of the Society of Arts*, London; the *Entomologist*, London; the *Bulletin de la Société d'Acclimatation de France*, Paris; and the *Isis*, Berlin. Many of these wild silkworms produce silk of great strength and beauty, and could all be profitably utilized, if bred in their native lands, on a large scale. Specimen cocoons, and carded and reeled silks of about twenty different species, have been sent to the Société d'Acclimatation, and they will be exhibited in the Paris International Exhibition of 1889, together with specimens of the moths and prepared larvæ of the various species. As it is highly important that this exhibition should be as complete as possible, Mr. Alfred Wailly of Tudor Villa, Norbiton, Surrey, Eng., has been requested by the Société d'Acclimatation to send all new specimens he can collect from abroad. He is therefore desirous that sericulturists, entomologists, and all persons wishing to contribute to the formation of this large and interesting collection of the wild silkworms of the world, should communicate with him, and he requests them to kindly send him, in small or large quantities, specimens of live cocoons, with names of food-plants for each species, whenever possible, and also specimens of the moths. Live cocoons, which are specially required for the rearing of the species, should be sent to Europe from October till about the end of March, according to distance: when sent later, especially when sent from tropical regions, the moths generally emerge during the voyage, and all is lost.

— Some large plumb-line deflections have been brought to light in the Hawaiian Islands, amounting in several cases to almost a minute of arc. During the past year fourteen latitude and three gravity stations have been occupied on the principal islands of the group. Gravity was determined by pendulum observations at the base and summit of Haleakala (ten thousand feet elevation), and also at Honolulu, thereby connecting this work with the work of 1883 done by the United States Solar Eclipse Expedition. About fifteen hundred measures of latitude were made, being an average of more than a hundred measures for each station. The greatest number of pairs observed on any one night was seventy-five. Four stations were made on the island of Hawaii, and as near as practicable they were placed north, south, east, and west of Mauna Loa, the active volcano. One latitude station was also made on the top of Haleakala. The expense of the work was borne by the Hawaiian Government Survey, and the stations were selected by the surveyor-general, Prof. W. D. Alexander. The necessary instruments were loaned by the superintendent of our Coast and Geodetic Survey. Mr. Preston, who made the observations, estimates about a year for their complete reduction and discussion.

— With the object of considering well the various forestry needs of Michigan, the last Legislature enacted a law making the members of the State Board of Agriculture an independent forestry commission. In accordance with this act, the commission will hold a forestry convention at Grand Rapids, Jan. 26 and 27, for the purpose of gathering and disseminating information, and helping to awaken an interest in this important subject.

— Rev. Ebenezer V. Cooper, missionary at Huahine, Society Islands, has communicated to the *San Francisco Bulletin* the death of Andrew Garrett as follows: "Andrew Garrett, a celebrated conchologist, died at his residence on the island of Huahine, Society Group, South Seas, on the 1st of November, 1887, in the sixty-fifth year of his age. For some months past he had suffered from a severe form of cancer in the face, which attack brought about his death. Mr. Garrett was the third child in a family of fourteen, and was born on the 9th of April, 1823, in Beaver Street, Albany, N.Y. His mother was one Joanna van Neau Companeaux, a native of Belgium, of good education, and speaking several languages; his father being a Francis Garrett, a native of Canada. Both parents lived to old age, the mother attaining seventy-two years and the father eighty-four years. The early life of Andrew Garrett was spent in Vermont State, where he very soon manifested a decided scientific turn of mind. On one occasion, at eight years of age, he left home without warning, to visit a museum some hundred miles away, which having accomplished, he returned home again in safety. He had a great fondness for travel; and to satisfy the longing, he went to sea at the age of eighteen. As a shell-collector he made his first acquaintance with the South Pacific in 1848, and in 1852 he ultimately adopted that island-studded ocean as his special field of research. Since that time Mr. Garrett has visited almost every island of note in the various groups of the South Pacific, spending considerable time in each group. His studies not only embraced shells of the marine, fresh-water, and land orders, but also birds, fishes, and other objects of natural history. He was also a botanist. For one period of ten years he was professionally engaged in the interests of the Goddefroy Museum, Hamburg, during which time was published 'Andrew Garrett's Fische der Südsee,' in six parts, edited by Dr. Albert Günther of the British Museum. Mr. Garrett was also for a time associated with Professor Agassiz. In addition to visiting and residing in every group of islands of the Southern Pacific, Mr. Garrett visited and explored many parts of the Atlantic and Pacific coasts of South

America, the East and West Indies, the Sandwich Islands, and some parts of the united seas. His diligent and learned researches soon gave him a place as an authority among conchologists, — an authority now everywhere recognized. His correspondents were very numerous, residing in all parts of the world. Mr. Garrett's private collection of shells (now on sale) consists of over eight thousand species, comprising over thirty thousand examples, and representing almost every known part of the globe. Of this large collection, Mr. Garrett has himself collected some four thousand species. The deceased was a corresponding member of the California Academy of Sciences and of the Philadelphia Academy of Natural Sciences. The following is a list of Mr. Garrett's principal writings: in Proceedings of Zoölogical Society, London, list of *Mitridæ* collected at Rarotonga, Cook's Isles; descriptions of two new species of *Separatista*, of two new species of *Cœcum*, of a new species of *Scissurella*; 'On the Terrestrial *Mollusca* of the Viti Islands:' in the *Quarterly Journal of Conchology*, Leeds, England, 'Occurrence of *Crepidula aculeata* at the Marquesan Islands;' 'Occurrence of *Gadinia reticulata* in Eastern Polynesia;' 'Annotated Catalogue of the Species of *Conus* collected in the South Sea Islands;' 'Catalogue of the Polynesian *Mitridæ*, with Remarks on their Geographical Distribution, Station, and Description of Supposed New Species;' 'Annotated Catalogue of the *Cypraoidea* collected in the South Sea Islands:' in the *Bulletin of the Société Malacologique de France* (Paris), 'On the Terrestrial *Mollusca* of the Marquesan Islands:' in the *American Journal of Conchology*, vol. vii., 'Descriptions of New Species of Land and Fresh-Water Shells from the South Sea Islands' (plates); 'List of *Viti Bulimus* and Descriptions of new Species' (plates): in the Proceedings of the California Academy of Natural Sciences, 'Descriptions of New Species of Shells inhabiting the Sandwich Islands;' 'Descriptions of New Species of Fishes inhabiting the Sandwich Islands;' 'Description of New Species of South Sea Shells:' in Proceedings of the Academy of Natural Sciences, Philadelphia, 'On the Terrestrial *Mollusca* inhabiting Cook's Islands, Society Islands, and Samoan Group;' 'List of Land-Shells inhabiting Raraturu (one of the Austral Islands), with Remarks on their Synonymes and Geographical Range;' and several other papers."

— In seven months of the year which closed Dec. 31 the Metropolitan Ayslums Board authorities of London had dealt with no fewer than 5,166 scarlet-fever patients; for 203 cases were admitted in June, 359 in July, 521 in August, 1,041 in September, 1,287 in October, 982 in November, and 773 in December. The board had at one time as many as 2,780 fever patients under treatment at one time, and, as a result of the general public utilizing to a greater extent than had ever been previously recorded the accommodation provided at the public expense, seven large hospitals had to be opened, and additional hut-accommodation provided. Fortunately the disease was not of a severe character, and the death-rate was not heavy. The admissions in September and October ranged as high as 50 and 60 per diem, but the disease has since sensibly declined. There were on the last day of 1887, 2,224 patients under treatment, suffering from fever of all kinds, but many of these patients are rapidly regaining health. One feature of the epidemic was the opening of the magnificent hospital for convalescing patients at Winchmore-hill, and another was the ready answer given to an appeal made by Miss Baker in the columns of *The London Times* for toys for the children. During 1887 London has, for the first time for many years, enjoyed an immunity from any serious amount of small-pox; for, although individual cases have occurred, very beneficial results have accrued from prompt removals and isolation of the disease.

— The *Publishers' Circular*, London, Eng., states that the total number of new books and new editions published in 1887 is not far from 500 in excess of the books of the previous year. Theology shows an increase of 60 or 70 on the last return. There are more than 100 educational works over the product of 1886, while in juvenile works the increase is less marked. Novels keep up their average of more than two per diem, Sundays included. Politico-economical books are less in number than usual, which is also the case in the department of arts and sciences, which includes illustrated volumes. In voyages, exploration, and books descriptive of countries, we find about 50 new books recorded more than for 1886, while in history and biography there is a notable rise in the issue of new works, — over 100. Poetry and the drama are about equally represented with last year. In medicine and surgery, in belle-lettres and essays, as also in miscellaneous publications, a slight increase of production is shown.

— Mrs. Ayrton, the wife of the professor at the Technical School at Kensington, England, is going to give a course of experimental lectures on the practical uses of electricity to ladies. Mrs. Ayrton was educated at Girton College.

— The general meeting of the Association for the Improvement of Geometrical Teaching, London, was held Jan. 14. The following papers were read: 'The Recent Geometry of the Triangle,' by Mr. R. F. Davis; 'On the Multiplication and Division of Concrete Quantities,' by Prof. A. Lodge; and 'On some Principles of Arithmetic,' by Mr. W. G. Bell.

— A sufficient sum has been collected for the erection of a monument at Köping, in Sweden, in memory of the celebrated chemist and apothecary, Charles William Scheele, who was born, 1742, at Stralsund, and died, 1786, at the above-named town.

— The Argentine Information Office has just published an excellent map of the Argentine Republic, on the back of which is given a short description of the country and the latest information as to its political organization, agriculture, industries, commerce, revenue, and expenditure, railways, and various other subjects of interest.

— The Government of Batavia has given notice to the admiralty that the commander of His Netherlands Majesty's ship 'Samarang' reports the existence of a low, wooded island, hitherto uncharted, lying westward of Selaru, Timor Laut Islands. The island is reported to be about two miles long in a north-north-easterly and south-south-westerly direction, and about two-thirds of a mile broad; position as given, centre of island (approximate), latitude 8° 15′ south, longitude 130° 39′ east.

— A communication from the Government of Queensland to the admiralty states that the natives of Stephen Island, on the eastern side of Great North-East Channel, Torres Strait, who were formerly very ferocious and hostile, are now thoroughly quiet: they are supplied by the Government of Queensland with a boat, and are prepared to render assistance to any passing vessel requiring their services that will hoist a flag at the mast-head. Yams, sweet-potatoes, and cocoanuts can be obtained from these natives. There is good anchorage with south-easterly winds off the north-western end of the reef surrounding Stephen's Islands. At Murray Islands a mission station is established, where shipwrecked crews will be kindly treated, and taken to Thursday Island. At Darnley Island complete confidence can now be placed in the natives.

— In *Science* of Dec. 30, 1887, p. 323, second column, 23d line from bottom, the first 'south-west' should read 'south-east.'

LETTERS TO THE EDITOR.

*** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

Twenty copies of the number containing his communication will be furnished free to any correspondent on request.

The editor will be glad to publish any queries consonant with the character of the journal.

The Snow-Snake.

THE writer of an interesting article on Pocahontas, in a recent popular periodical, had evidently been reading up Morgan's works rather than early Virginia writers. The "hunting lodges, built up of mats, which they remove as they please," become "long, low houses of bark, . . . twenty families to a house." The "great fire made in a long house" becomes five, "each fire being shared by four families." The one seat at the end of Powhatan's house expands into stalls and bunks all around; and while it is said that "no one, in any household, was better off or of higher rank than his brothers or sisters," yet Powhatan is described as having "such an influence over his tribesmen that he was regarded as the head man (president, we might say) of this forest republic, which comprised the thirty confederated tribes of Powhatan." These questions need not be discussed now, but such statements ought not to be made history.

My attention was directed to the article by a friend, who was surprised by a mention of the snow-snake among these primitive Virginians. The children indoors were playing at *gus-ha-eh* (or 'peach-pits'), it is said; but where the peaches came from at that early day is not explained. The "boys were tumbling about in the light snow, at their favorite game of *ga-wa-sa* (or the 'snow-snake')." The use of these Seneca words sufficiently shows the source of information, but it is not wise to place a Northern game so far South. Something more than a light snow is required for this sport; and boys do not tumble about in it, but stand up to their work. Neither would any one risk breaking the graceful shaft between the legs of one running at full speed.

I was recently surprised at not finding the snow-snake in the collection of Iroquois implements at the Museum of Natural History in New York, and still more to learn how few students of Indian life know any thing of it. A game something like it is found among some Western Indians, but the implement used is very different. Nor do I now recall any mention of it among early Indian games. That it would not be of general use is in the nature of things. Only in those colder regions where an icy crust often forms would it naturally occur. Even there it may be recent, as the head is always weighted with metal, melted into grooves, and nicely smoothed. Of course, this might have been different if its use was ancient. Morgan describes the Seneca snow-snake as being from five to seven feet long, and he gives a good figure and description. Those of the Onondagas are often longer. Mine is of their medium

size, and is upwards of seven feet long, while I have seen many not less than nine feet in length. They are very neatly made, for any irregularity would interfere with successful use. The smaller notched end of mine is but a trifle over half an inch wide by about a quarter deep. This increases to seven-eighths of an inch wide by one-half deep just back of the raised head at the other end. The head begins to rise about six inches from the extreme point with a gradual curve. Lead is inlaid in this, often in a pretty pattern; and I have thought it barely possible, granting its antiquity, that stone bird amulets may once have formed the heads. These seem to belong to woodland regions, where the winters are long, but such a use is hardly probable.

The game is simply one of dexterity and strength. The forefinger is placed in the basal notch, the thumb and remaining fingers reaching along the shaft, and the snow-snake is thrown forward on the ice or hard snow. It might go a little way through light snow, but this is not favorable to its use. An icy crust or the track of a sleigh, the travelled road, or even ice, are favorite resorts. A much worn road would injure the fine polish of the implement, and a level surface, with a good crust, is commonly chosen. On a fine winter's day men and boys are often seen in such places, pursuing this sport. They play quietly, for the Onondagas are a very quiet people, and one out of sight might know nothing of the most exciting game. When the slender shaft is thrown, it glides rapidly over the surface, with upraised head and a quivering motion, that gives it a strange resemblance to a living creature. The Christian Onondagas have abandoned its use, perhaps because betting is a feature of the game, or it may be they dislike its symbolism; but I think the former the true reason. The Senecas call it *ga-wa-sa*; the Onondagas, *ka-wher-tah*; neither of these words referring to its snaky appearance. I am unable to learn of any idea attached to the name, and this favors an early use. The game is to see which person or side can throw it farthest, and sometimes the distance of a quarter of a mile is reached under favorable circumstances, but I think this rare. W. M. BEAUCHAMP.

Baldwinsville, N.Y., Dec. 30.

The Conspiracy of Silence.

THE Duke of Argyll's charge of a conspiracy of silence among scientific men, by means of which new truths are to be ignored, has been perhaps sufficiently answered. In fact, according to the duke's own statement, the theories of Messrs. Murray and Guppy are already printed, and are before the public for judgment. This discussion has been interesting, but, so far as I have seen, two points worthy of attention have not been brought out.

1. There is in all branches of learning a just and good conservatism. We cannot afford to give up scientific truths that have been acquired with much labor and difficulty. Hence, when theories are proposed that conflict with established principles, they are to be received with caution. No one can believe in perpetual motion until our theory of dynamics is overthrown. A mathematician who claims to solve the equation of the fifth degree will have a hard time in finding believers. If a writer on theoretical astronomy violates the rules of the calculus, he has no right to ask the respect of astronomers. He deserves to be ignored. Astronomers should not spend their time in demolishing absurd theories that may be proposed to them. The age of Don Quixote is past.

2. But in the discussion which has taken place the assumption seems to be made that scientific men are better, or ought to be better, than other people. Although this might be taken as a tacit compliment, I think it is a mistake. The truth is, that scientific men are very much like other people. They have the same desires, the same passions; and they will have the same greed for money and fame that other people have. If they place themselves on a footing devoid of morals, they will develop as mean men as the world has ever seen. But it is not simply from the character of the men who do scientific work that we are to look for good results. These come rather from the scientific method, which, in its final judgment, pays no regard to the condition of the worker. The question is only if his result is right. The dissipated young Frenchman, Galois, was killed in a duel at the age of twenty-one, but his genius was so powerful that he left an indelible mark on the old science of mathematics. His work remains, and in using it we do not consider Galois and his extreme republican principles. ASAPH HALL.

Washington, D.C., Jan. 10.

One of the Causes of the Inefficiency of the Reis Telephone.

SOME who have experimented with the Reis telephone declare that they have never been able to hear a transmitted word. Others have heard some words and sentences; but these have always been weak and irregular, so as generally to discourage one in a short time, especially now, when through the improvements in telephones it is possible to reproduce words both loudly and regularly. Experimenters therefore have been impatient with Reis's apparatus, and seldom have done any thing with it, except make some hasty tests for some phase of the great telephone controversy.

The inefficiency of the Reis telephone has, by a kind of common consent, been admitted to be altogether due to the imperfect mechanical operation of the transmitter, by which the making and breaking of the current when it is in operation is such as not to properly follow the actual vibratory movements of the diaphragm when the latter is moved by speech-vibrations; that at best it can deliver to the line only the fundamental rate of the vibration, leaving out the characteristic over-tones which are supposed to be necessary to the successful transmission of speech. This judgment as to the mode of operation of the transmitter has been derived wholly from what has been heard by one listening at the receiver; for there is to-day no known method by which it may be determined whether or not a transmitter has the proper motions, except by listening at the receiver. That is the test. Hence it has been concluded, that, if speech was not properly delivered in a receiver, the trouble must be with the lack of proper movements of the transmitter. Yet it is mechanically possible for the transmitter to move properly, and the receiver to be so much overloaded, so to speak, that the latter fails to be heard on account of the extra disturbance.

The Page effect — the magnetic click — may be so strong in a Reis receiver, with a proper current, as to be heard a good many feet distant from it. When the receiver is held against the ear, the sound may be very loud; so much so as to quite drown weaker sounds, if they happen to be present. Especially when these loud sounds occur fifty or one hundred or more times per second, the effect is that of a continuous sound; and as the persistence of hearing is something like the tenth of a second, it follows, *a priori*, that such rates of vibration as from two hundred to a thousand per second might be present, yet too weak to be heard in the presence of such overpowering sounds that have an appreciable persistent effect. These loud magnetic clicks are heard only when there is a sudden break in the current in the receiver. If, then, some way can be devised for preventing these extraneous sounds in the receiver without interfering at all with the transmitter or its 'mode of operation,' one may experimentally determine whether the Reis transmitter does or does not act mechanically so as to vary the current in correspondence with speech or other sound-vibrations. I therefore conceived, that, if there was a short-shunt circuit between the terminals of the transmitter, some of the current would traverse the coil of the receiver the whole time, no matter whether the circuit through the transmitter was open or closed. The loud clicks would be suppressd without interfering in any way with the 'mode of operation' of the transmitter; and, if the latter really did follow the motions of the diaphragm, the variations in the current strength would correspond, and the speech would be heard. This I found to be truly the case: for with a transmitter thus provided with a shunt circuit of about two ohms, which could be switched in or out with a key, it was at once possible to hear a large part of what was spoken when the shunt was in; when it was out of circuit, the sounds were generally inarticulate.

This experiment is an *experimentum crucis*, and proves that the inefficiency of the Reis telephone is much more due to the extraneous sounds in the receiver than to the lack of appropriate motions of the platinum terminals of the transmitter. It proves that the transmitter does and must always have worked in the proper mechanical way, and that the current theory of its mode of operation is not correct. It proves, too, that when carbon is substituted for the platinum terminals, there is an improvement in efficiency, but not in its mode of operation.

A. E. DOLBEAR.

College Hill, Mass., Jan. 14.

Queries.

23. DROPS OF WATER.— Will some reader of *Science* explain the floating of drops of water upon the general surface? It is a very common phenomenon, not to be confused with the formation of bubbles, though often produced by the same sort of agitation; for example, the breaking of a wave. In still water they may be produced by an oblique blow with an oar or with the hand, but will disappear as soon as their original momentum has been lost. Recently on Lake Pontchartrain, with a brisk wind which kept them in motion, I observed some which exceeded an eighth of an inch in diameter, and lasted more than two minutes. The depression, like that of a floating needle, which surrounded each one, was also plainly visible. Their behavior was in striking contrast with that of the bubbles with which they were mingled, the drops moving much more rapidly with the wind, and also rolling under the influence of gravity towards the trough of each successive wave.

E. J. POND.

New Orleans, Jan. 9.

Answers.

21. GLOBULAR LIGHTNING.— The note on globular lightning in the issue of Dec. 30 recalls to mind a phenomenon of the kind I witnessed some years ago. While walking upon the Worcester and Norwich Railroad track about a mile south of Worcester Junction, I suddenly saw a ball of fire, or what looked like it, about the size of a large marble, running along on top of one of the rails just ahead of me. It was going at so slow a rate that I could have overtaken it in a few seconds, and my first impulse was to do so; but the sober second-thought warned me against making the attempt. I, however, watched it move until it came to the end of a rail separated from the adjacent one by something like half an inch, when it stopped, and in a second or two vanished, when there was a clap of thunder in a cloud overhead which I had not before noticed as being a thunder-cloud. The brightness of this small ball was not excessive, nothing to be compared with an electric arc. It was more like that of a red-hot bullet. It did not scintillate or make any noise, that I noticed. Now, while this was an accompaniment of a thunder-cloud, as are such manifestations generally, I think there is some reason for not calling the phenomenon itself an electrical one in the same sense as lightning is electrical. If electricity can gather itself up into a spherical form as if it was subject to some sort of cohesion, and if it can roll along on top of a good conductor instead of traversing the body of the conductor subject to Ohm's law, then there are some exceptions to this latter law. Other observers have seen still larger balls roll slowly upon the ground, or move with great deliberation in the air, apparently without exhibiting the property of attraction or repulsion. Some years ago an acquaintance in southern New Hampshire told me that such a fire-ball came down to the ground near his house, and rolled slowly about near where a hog was. The hog walked up to it as if to root it along, and touched it with its snout, when it exploded with a great noise, killing the hog instantly, blowing it to pieces. In this case, and in other similar ones, it appears that the luminosity is not caused by high temperature. Babinet reports a case that he investigated, where a globe of fire came into the room of a tailor who was eating his dinner. It was about the size of a child's head, and moved about upon the floor, approaching his legs as a kitten might have done; but he prudently drew his feet away, and watched it. It appeared bright, but the tailor said he felt no sensation of warmth. After remaining several seconds upon the floor, it rose vertically five or six feet in the air, and then moved towards a pipe-hole in the chimney, which was covered with paper, which it tore off, and went up the chimney. Near the top it exploded, and did considerable damage to the chimney and the roof of the house. Such a performance is entirely unlike electrical phenomena. It exhibits none of the characteristics of electricity, either in form, in motion, in heat, in attraction, and why should it be called an electrical phenomenon? It is true, in most of the cases reported the disruption of the globe resulted in electrical phenomena, sudden and destructive; but so would a charged secondary cell, that might have relatively a very large amount of potential electricity in it: that is, the stored chemism may be transformed into electricity at a very rapid rate, but we do not now consider that electricity is stored in the cell, because we can get a large amount of electrical energy out of it. The charged secondary cell is the result of electrical work; but, so long as the energy is stored in such a way as to manifest none of the properties of electricity, it is improper to speak of it as other than chemism. In like manner, if energy be stored in such a globular form as is called 'globular lightning,' which does not exhibit any of the properties of electrical energy, it seems to me that we are not justified in calling it an electrical phenomenon. We have in physics already too many *ex post facto* terms, such as 'heat' rays, 'light' rays, and 'actinic' rays; and it is a pity to call this 'globular lightning' if the only appropriate part of the name is 'globular.' If we don't know what specific form the energy exists in, we know that it is globular energy; and 'globular vim' would be better than 'globular lightning.'

A. E. DOLBEAR.

College Hill, Mass., Jan. 12.

22. WASP-STINGS.— In answer to Mr. Ames's query in *Science* for Jan. 13, I will say that I have picked up hundreds of lively wasps, holding my breath at the moment when the wasp was grasped, and have never been stung under such circumstances. I have frequently been stung by wasps when I have disturbed them unawares, which shows that there is nothing in my make-up which would prevent wasps from stinging me if they had the power and were so disposed. I have captured a dozen wasps, one after the other, until I had a handful, which I have held as long as I chose, without receiving a single sting. I cannot say that I would have been stung had I not held my breath at the moment of contact with the wasps, but can only testify that I was not stung in a single instance when I did hold my breath. As to the explanation of the phenomenon, I have none to give. I have tried the experiment on hornets, honey-bees, and bumblebees, and a single trial with each was sufficient to prove that the plan did not work with either of these species.

FAYETTE SAFFORD.

Willimantic, Conn., Jan. 16.

BOOK-NOTES.

— A valuable article on our oil-fields is contributed to the February number of *The Chautauquan* by Charles Ashburner, assistant geologist of the Pennsylvania Survey.

— Messrs. Ticknor & Co. announce for immediate publication, 'Trinity Church, Boston, Mass.,' Monographs of American Architecture, No. V., — a portfolio giving twenty-two gelatine views and one heliochrome, thirteen by sixteen inches, of this celebrated church.

— Messrs. Ginn & Co. will have ready early in February next, 'The Vicar of Wakefield,' annotated for the use of schools, in their series of Classics for Children.

Calendar of Societies.

Philosophical Society, Washington.

Jan. 7. — George F. Becker, The Rounding of Rock-Masses by External Attack; J. W. Spencer, The Iroquois Beach, a Chapter in the Geological History of Lake Ontario; Bailey Willis, Determination of Fault Hades.

Biological Society, Washington.

Dec. 31, 1887. — W. J. McGee, The Overlapping Habitats of *Sturnella magna* and *S. neglecta* in Iowa; C. Hart Merriam, Description of a New Field-Mouse from Western Dakota; W. B. Barrows, The Shape of the Bill in Snail-eating Birds; H. Justin Roddy, Feeding-Habits of Some Young *Raptores*.

Anthropological Society, Washington.

Jan. 3. — H. W. Henshaw, A Linguistic Map of the United States, with Explanations; Washington Matthews, A Navajo Shaman's Prayer.

Boston Society of Natural History.

Jan. 4, 1888. — W. O. Crosby, The Geology of the Outer Islands of Boston Harbor; James H. Emerton, The Anatomy of the Chrysalis of the Milk-Weed Butterfly.

Appalachian Mountain Club, Boston.

Jan. 3, 1888. — David P. Todd, The Ascent of Fuji-san, Japan.

Jan. 11. — Miss L. S. Davis, Monument to de Saussure.

Engineers' Club, St. Louis.

Dec. 21, *Election of Officers.* — President, M. L. Holman; vice-president, J. A. Ockerson; librarian, J. B. Johnson; secretary, William H. Bryan; treasurer, Charles W. Melcher; directors, William B. Potter and F. E. Nipher.

Isaac A. Smith, Rapid Railway Embankment Construction.

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SCIENCE

FRIDAY, JANUARY 27, 1888.

THE GROWTH OF SCIENCE is well illustrated in the recent appearance in the *Century* of the series of articles on the new astronomy by Prof. S. P. Langley. These have been republished in book form by Messrs. Ticknor & Co. of Boston. We now have a new chemistry, a new physics, and a new astronomy; and, owing to the way in which the older brothers or older sisters have been endowed, these new-born sciences find themselves without the pecuniary means for their proper support. To quote from Professor Langley's preface, it is not generally understood that among us not only the support of the government, but with scarcely an exception every new private benefaction, is devoted to the old astronomy, which is relatively munificently endowed already, while that which he has called the new, so fruitful in results of interest and importance, struggles almost unaided. The great national observatories, like Greenwich or Washington, are the perfected development of that kind of astronomy which was only interested in recording the movements of the solar system. From primitive times man knew where the sun would rise on a certain day; and the record of this knowledge is left us in the prehistoric buildings, if such they may be called, of Britain. At Greenwich the moon has been observed, with scarcely an intermission, for a hundred and fifty years, but not for the purpose of seeing what it was made of, but for the purpose of forming the lunar tables, which, by means of the moon's place among the stars, will give the navigator his positions. In the same way at the Washington observatory one may see a wonderfully exact instrument strongly bolted to massive piers, and so immovable that the sun can be observed by it but once daily as it crosses the meridian. This instrument is the complete attainment of that long line of progress in one direction of which the prehistoric stones at Stonehenge mark the initial step, — the attainment, that is, purely of precision of measurement. The new branch of astronomy, which has had its entire growth within a few years, studies sun, moon, and stars for what they are in themselves and in relation to ourselves. Its study of the sun, beginning with its external features, led to the further inquiry as to what it was made of, and then to finding the unexpected relations which it bore to the earth and our own daily lives on it. This new branch of inquiry is what Professor Langley calls the 'new astronomy;' and it is for this new astronomy — this study of the celestial bodies to find out their nature and their relation to us, rather than for the purpose of simply recording their relative motions — that Professor Langley has made so beautiful and so eloquent an appeal for the proper endowment of this new field of research. No one can read this book of Langley's without feeeling that astronomy has acquired an entirely new interest for him. It now results in something more than the dry-looking pages upon pages of tables.

THAT THE ORIGIN of color-blindness lies in the brain, and not in the eye, has been suggested by Professor Ramsay. While engaged in teaching in Brooklyn some years ago, the principal of a school insisted in treating every case of the sort as dependent on the will of the pupil. His remedy was the rod. This certainly seemed a tyrannical and unwarranted treatment, but the result was favorable to his theory. Is it possible that a thorough examination will ultimately demonstrate that the fault lies very largely in the shiftless methods of observation which have grown up under the old classical system of education, and which have to a large extent become hereditary? Professor Ramsay's suggestion and his argument deserve careful attention, and, if found correct, we have another and overwhelming reason for the newer education. At first sight, it is not perfectly clear, on the above theory, why it is that color-blindness should be more common among men than among women; yet it is possible that this will be found to bear out the suggestion made above, for, with the discontinuance of the wearing of colors by the men, their interest in colors to a large extent must have ceased; and if our old methods of education were to be continued much longer, it may be, that, with the less use of color by women in their dresses, an increase of color-blindness might result among them as well. It is doubtful, however, whether the introduction of the rod as a quick corrective will find many advocates.

VOLAPÜK.

THIS is the name of an artificial language recently devised for international use. Similar attempts have been made at various times to produce a vehicle of uniform expression for the world's speakers; but modern literature knows nothing of these efforts. All have been abortive. Will Volapük be more successful?

A universal language must have a phonetic representation — a 'real character' — that shall be easily and uniformly intelligible to all readers. The new candidate for universality is in the mean time unprovided with any international medium of writing. It cannot, therefore, while this want is unsupplied, be diffused as a spoken language. Take, for example, the title 'Volapük.' The English reader deciphers this word into the syllables 'Vol-a-puk,' with customary sounds; but the intended pronunciation is 'Voh-lah-puek.' A French or a German reader would have no difficulty with the syllable 'pük,' but the English system of letters can give our readers no idea of the sound. The employment of Roman letters, while they have such diverse phonetic values in different languages, must effectually prevent the oral use of Volapük in different countries. As a written language it might still, however, be of service.

Is Volapük the best language that science can create for this ideographic purpose? Is it superior to previous essays of the same kind? The most elaborate and complete of all earlier schemes for a universal language is undoubtedly that of Bishop John Wilkins. This system was printed for the Royal Society in 1668. The analysis and the classification of ideas, on which the 'Philosophical Language' is founded, are beautifully ingenious. A similar principle of arrangement was afterwards adopted by Dr. Roget in his well-known 'Thesaurus of English Words and Phrases,' — a book, by the way, which owes its existence to the labors of Bishop Wilkins, although no acknowledgment of such indebtedness is to be found within its pages. The bishop's scheme for a universal language is indeed referred to, but only as having been "soon found to be far too abstruse and recondite for practical application;" while no mention is made of the grand feature of the work, on which the whole scheme is based, — the fundamental grouping of thoughts and expressions. This feature is simply, silently appropriated in the 'Thesaurus.' The latter is a very cleverly executed work; but the credit of its plan, however improved by Dr. Roget, should have been ascribed to the original designer, Bishop Wilkins.

Before examining the details of Volapük, let us look at some of the characteristics of the older scheme. The complete categories of ideas are comprised under forty 'genuses or heads,' to each of which a radical sign is appropriated. This sign is susceptible of the addition of subordinate marks, which, on defined principles, signify species, differences, etc. The resulting geometrical figures make up the 'real character.'

The application of the system is illustrated in the Lord's Prayer and the Creed. The signs for the ideas 'heaven' and 'earth' are thus explained:—

"[*Heaven*] This Generical Character is assigned to signifie World, the right angled affix on the left side, denoting the second Difference under that Genus, namely Heaven; and because there is no affix at the other end, therefore doth it signifie the Difference itself, and not any Species."

"[*Earth*] The same Generical Character signifying World, the affix making a right Angle, doth denote the second difference under that Genus, namely the Celestial parts of it in general, amongst which, this Globe of Sea and Land whereon we live, is reckoned as the seventh Species, denoted by the affix at the other end."

These examples suffice to show the nature of the 'real character,' which is obviously adapted for universal writing, because the ideas expressed by the signs are translatable into the words of any language.

The Roman alphabet (with additional letters) is also made use of in application of the system to individual languages. The same forty 'genuses' are expressed by simple syllables, such as *ba, be, bi*, etc.; the differences under each genus being denoted by sequent consonants, as in *bab, bag, bad*, etc.; and the species by putting a vowel after the consonant, as in *deba, deta, gade, pida*, etc.

A few words may be quoted to show the nature of the verbal forms in this 'philosophical language:'—

al = 'the'	*lal* = 'from'	*odab* = 'body'
coba = 'father'	*lil* = 'at'	*odad* = 'hell'
cobas = 'son'	*me* = 'as'	*poto* = 'day'
Dab = 'God'	*mi* = 'no'	*Saba* = 'Lord'
dad = 'heaven'	*na* = 'and'	*salba* = 'kingdom'
e = 'he'	*nil* = 'but'	*tado* = 'power'
he = 'his'	*nor* = 'for'	*velco* = 'lead'
	velpi = 'give'	

The principle on which these words are constructed may be understood from the author's explanation of the four following:—

"[*Coba*] Co doth denote the Genus of Oeconomical Relation; the letter [b] signifying the first difference under that Genus, which is Relation of Consanguinity; the vowel [a] the second Species, which is direct ascending; namely, Parent."

"[*Cobas*] The syllable [co] is assigned to the Genus of Oeconomical Relation, the letter [b] to the first difference, and the vowel [a] for the second species, the Letter [s] denoting the word hereby signified, to be an Opposite, viz. Son."

"[*Dad*] Da the Genus of World, and [d] the second difference, which is Heaven."

"[*Odad*] [Da] is the Genus of world, [d] is the second difference, which is Heaven, the vowel [o] which is opposite to [a] being prefixt, denotes this to be the word opposite to Heaven, viz. Hell."

In this way all thoughts find expression in fit words deduced from the associated meanings of their component letters. "Every Word being a description of the thing signified by it; Every Letter being significant, either as to the Nature of the Thing, or the Grammatical Variations of the Word; besides the constant Analogy observed in all kinds of Derivations and Inflexions." With all these advantages, however, the philosophical language would need a philosopher to use it.

Another part of Bishop Wilkins's work ought not to pass unnoticed; namely, his analysis of English sounds. This is far superior to that of any preceding writer, and also more complete than the schemes of the majority of subsequent phoneticians. If the bishop's scheme for a universal language must be set aside as being beyond the ability of average learners, the logical, grammatical, and phonetic principles evolved in its development must always command the admiration of students.

The new claimant for adoption as an international language proceeds on the principle of selecting roots of words from the vocables of existing languages; but the relation of the Volapük words to the English, German, French, and other words from which they are derived, is so far from obvious, that the learner is not assisted by it to remember the meanings associated with the roots. English is said to have furnished about forty per cent of the adopted roots, yet, in a vocabulary extending over upwards of forty pages, only twelve of the roots exactly correspond with their English prototypes. The roots might, indeed, just as well have been entirely arbitrary as to have been arbitrarily chosen in this fashion from existing words. The method of root-*building* proposed by Bishop Wilkins seems greatly preferable.

Root-words having been selected, they are provided with a very complete and on the whole simple category of definitive letters and syllables, for prefixing or suffixing, to show number, gender, case, tense, mood, etc. The simple grammar of English has not been taken as the model in this department, but the complex arrangements of highly inflected languages. This is unfortunate; for we may safely assume that the universal language to be some time adopted will express all verbal relations by separate words, and not by root-inflection. The student will then need only to memorize words, and he will not require to know any thing of case-endings and other grammatical subtleties. On the other hand, if these matters are considered essentials of a language, the inflective scheme of Volapük could hardly be improved on. For example: all plurals end in *s*; final *-a* denotes the possessive case, final *-e* the dative, and final *-i* the objective; masculine genders end in *om*, and feminine in *ji* (pronounced 'she'); adjective terminations are *ik* and *id*, adverbial *o* and *na*, degrees of comparison being *um ün*, and *umo üno*; active and passive verbs have their appropriate signs, as have also all persons, tenses, and moods; prepositions end in *ü*, interjections in *ö*, etc. The grammatical particulars to be attended to are very numerous, but the rules have the advantage of being absolute, and unburdened with exceptions. The inflective feature of the language must, however, present an unsurmountable obstacle to its popular employment.

We cannot think that Volapük solves the problem of a universal language. The system will naturally meet with the largest acceptance in countries which already possess an inflected language; for the manifest superiority of the Volapük inflections, in regularity and simplicity, cannot but impress those accustomed to the complexities and anomalies of inflection. Speakers of English are happily free from this source of difficulty, and to them Volapük cannot be acceptable. The English language is itself reaching out towards universality, under the influence of commercial and social necessities. The present form of the language may be considered as classical, and must be allowed to remain substantially what it is. But English is undoubtedly susceptible of modifying simplifications which would easily and perfectly fit it for international use. Let a committee be appointed, consisting of one British and one American member, to investigate the subject, and suggest such changes as would remove anomalies, and I feel convinced that they would readily create a new and simple tongue in the form of what may be called 'world English.' This seems to be the most hopeful direction in which to look for universal language.

ALEX. MELVILLE BELL.

THE PEOPLES OF SOUTH-EASTERN EUROPE.

AT the present time, when the idea of 'nationality' rules the fates of Europe, those states have to pass through the severest struggles which have the most heterogeneous population, the parts of which gravitate to different centres. This is particularly the case in Austria, and was the case in Turkey. The latter, however, has disintegrated to such an extent that many of the peoples formerly included in its territory have gained their independence.

The accompanying map shows the distribution of the peoples and the boundaries of the states of south-eastern Europe. At the present time, when the struggles of the Bulgarians for independence and unity excite so much interest, a description of their distribution is of particular importance. The map shows that they inhabit the greater part of Bulgaria, while in the eastern part Turks are intermingled with them. Eastern Roumelia, which by the uprise of 1886 joined Bulgaria, has a Bulgarian population in its western half, while numerous Turks inhabit the east, and Greeks occupy the coast. But the territory of the Bulgarians is not confined to these two districts, which practically form one state. The southeastern portion of Servia and ancient Macedonia is inhabited by them, and their territory extends northward to Ochrida. Their western neighbors are the Servians, of whom the Croatians and Slovenians form a branch. The map shows that they occupy the western part of this region from Montenegro and Servia northwestward, their greater number being under Austrian rule. While these peoples immigrated during the middle ages, numerous remains of the ancient inhabitants of south-eastern Europe are still extant, although in course of time much influenced by the immigrants of the middle ages. The most important of these are the Greeks in Greece and the adjoining parts of Turkey; on the Archipelago, Crete, and on many points of Asia Minor. Their distribution all around the coasts of the Ægean Sea and on the south-west coast of the Black Sea shows that they are principally a seafaring and trading people. Colonies of Greeks are found in all great cities of the Orient. Their neighbors are the Albanese, who live in the rugged mountains of the western part of the Balkan Peninsula, east of Montenegro. They are presumably descendants of the ancient Illyrians, although much doubt prevails as to their descent. In southern Eubœa and around the Gulf of Ægina they live among Greeks.

During the reign of the Romans over eastern Europe many peoples became Romanized. Their descendants are the Roumenians in Roumenia, Bessarabia, Transylvania, eastern Hungary, and the north-eastern corner of Servia. It is of interest that a number of them, widely separated from the main body, should live in the Pindus, near Berat, and in a few villages of eastern Thessalia.

The invasion of the Turks added a new element to these peoples, but there are only few places which are inhabited by them exclusively. Their principal territory in Europe is the eastern part of the Balkan Peninsula, between the mouths of the Danube, Philippopolis, and Constantinople; but, besides this, numerous isolated districts throughout the peninsula are inhabited by them. The number of Turks, however, in the outlying districts, which are not any longer under Turkish rule, has greatly decreased since the recent wars. The principal district of the Turks is Asia Minor.

In the north-western part of south-eastern Europe we find another foreign people settled among the Indo-Europeans, — the Hungarians, who belong to the Finno-Tartarian race. They occupy the greater part of Hungary, where Germans, Servians, Roumenians, Russians, and Slovenians are settled among them, and the eastern part of Transylvania. Last of all we mention the Germans, who are the neighbors of the Hungarians and Servians in the north-west, but have, besides, numerous colonies in Hungary, Transylvania, and near the mouths of the Danube.

The development of these numerous peoples is one of the interesting problems of European history. It is hardly possible to classify the peoples who in ancient times lived in these regions. During the middle ages numerous peoples — the Gauls, Romans, Goths, Huns, Avars, Petchenegs, and Cumans — invaded the peninsula; but the principal part of the population consists of the ancient Slovenes of Pannonia, who settled in course of time in the province of Moesia. About the middle of the seventh century we hear about their wars with the Byzantine empire. The most important event in the early history of the southern Slavic peoples is the invasion of the Bulgarians. Their descent is doubtful, for their language has been lost. Gaster points out that not only the relics of Bulgarian language, which consist mostly of proper names, but also certain customs, are in favor of the theory that they belonged to the Turkish peoples who ruled in southern Russia, and that with them came certain Finnish tribes. They crossed the Danube in 679 A.D., and in course of time subjected all peoples of south-eastern Europe. Within a few centuries they became amalgamated with the Slavic people, whom they had conquered, and thus formed the Bulgarian people of the present time. We need only to mention that the Turkish invaders found all these peoples settled, and added a new element to the numerous races and peoples of that region.

From this brief review of the facts it will be seen that there exists no homogeneous people in south-eastern Europe, but that all of them are the descendants of an extensive mixture of different peoples. Even the Greeks, whose language has comparatively little changed since the times of antiquity, have been greatly influenced by Slavic peoples.

As none of the states of this region comprises a population speaking only one language, and as at the present time the history of Europe is entirely ruled by the desire of each nation to be independent, the natural outcome of this state of affairs is a continuous struggle between the various peoples. But a glance at the map shows that the actual distribution of the peoples makes the establishment of states comprising only one people impossible. A Greek empire would exclude all other peoples from the sea; a Bulgarian state would include numerous Greeks, Turks, and Albanese. It is of great interest that these difficulties have only arisen in our century, for before this time the idea of nationality was hardly known. It is only since the French revolution that the tendency of all peoples speaking one language to form one state has grown up. To this idea Italy and Germany owe their existence, and it threatens Austria and Turkey with destruction. It is remarkable to see how people bitterly opposed to one another, not on account of diverging interests, but on account of difference of language, in Europe, become merged in our continent into one great people; how the same process that has been going on in Europe so frequently during the middle ages, but only by means of wars, is going on peaceably in America. Our map shows that so long as the same ideas and interests remain the leading ones in the history of south-eastern Europe, there is a constant source of wars and minor troubles, even aside from the contending interests of Russia and Austria to gain a foothold on the Ægean Sea, and England's fear of Russia's commanding the entrance to the Black Sea.

VALUES IN CLASSIFICATION OF THE STAGES OF GROWTH AND DECLINE, AND PROPOSITIONS FOR A NEW NOMENCLATURE.

AT the meeting of the Boston Society of Natural History, Nov. 16, 1887, Prof. Alpheus Hyatt presented a paper, of which the following is an abstract. He proposed, in accord with views previously published in his 'Larval Theory of the Origin of Tissue,'[1] and an abstract of the same subsequently printed in the *American Journal of Science*, May 31, 1886, to divide the animal kingdom into three comprehensive divisions: (1) *Protozoa*, unicellular animals, which propagate by means of asexual (autotemnic) fission and by spores, and build up colonies, but always remain typically unicellular; (2) *Mesozoa*, multicellular colonies, but composed of only one layer of cells, so closely connected that they form a layer of primitive tissue. They have more or less spherical forms, and propagate by means of ova, spermatozoa, and by autotemnic fission, and have an aula or common cavity, but no specialized digestive cavity or archenteron; (3) *Metazoa*, complexes of multicellular colonies, in which growth by sexual union and resulting fission of the ovum form three primitive tissue layers, and build up a body in which an archenteron is always developed, they propagate always by means of ova and spermatozoa, autotemnic fission occurring only, if at all, during the earliest stages of the ovum.

The stages of holoblastic ova may be in a general way classified as follows, to accord with that given above for the animal kingdom: —

(1) The ovum or monoplast (Lankester); (2) the first stage of segmentation, which normally results in the production of two cells, the *Monoplacula*; (3) the second stage of segmentation, in which two layers arise, the *Diploplacula*. The first two stages alone seem to have parallel or representative adult forms among *Protozoa*. He proposed to classify these stages under the name of 'protembryo.'

(4) The blastula is in aspect and general characteristics the morphological equivalent of the adults of the genera *Volvox* and *Eudorina*, the types of the *Mesozoa* or *Blastrea*. The latter are animals in which growth remained permanently arrested at the single-layered, spherical stage in the evolution of tissue-building forms. He proposed to classify these stages under the name of 'mesembryo.'

(5) The gastrula can be compared, as has been done by Haeckel, with the lower *Porifera* (*Ascones*), but these have three layers like the lowest *Hydrozoa*, in which a three-layered gastrula-like stage has been permanently preserved. The proper name for these stages would therefore be 'metembryo,' in allusion to the fact that the ovum at this stage was probably essentially a metazoon, or a near approximation to this type.

[1] Proceedings of the Boston Society of Natural History, vol. xxiii. 1884, p. 45.

(6) The first and simpler planula stages, though often characteristic of the larger divisions of the animal kingdom, do not possess, as a rule, the essential, diagnostic characters of the larger divisions to which they belong, and he proposed to call them 'neoembryos.' Examples: the *Cinctoplanula*, the planula of the *Cœlenterata*, the *Pluteus*, the *Trochosphere*, the *Pilidium*, the earliest planula-like ciliated stages of *Amphioxus*.

(7) The latest of the more specialized planula-like stages are either directly transformed into, or else give rise to, other forms in which the characters of the larger divisions or types of the animal kingdom begin to appear, at least so far as essential characters are concerned. Examples: the *Ascula* and *Ampullinula*, the *Actinula*, the *Gulinula*, the *Veliger*, the internal worm-like form arising in *Pilidium*, the stage of the formation of the notochord in *Amphioxus*. He proposed, therefore, to interpret these relations by naming the embryo in these stages the 'typembryo.' This term can be applied to the *Nauplius* of *Crustacea*, and the *Echinula*[1] of *Echinodermata*, as well as to those above noted.

The application of such principles to the study of the younger stages of fossil *Cephalopoda* was productive of what seemed to be satisfactory results. The protoconch of Owen is, according to this nomenclature, a shell of a univalve *Veliger* among the cephalous *Mollusca*, and a typembryo, which, though eminently characteristic of that group, has no exact morphological equivalent among normal adult forms of recent or fossil shells.

The true larval, or, as they are here named, silphologic (Σίλφη, 'a grub') stages began with the formation of what Owen appropriately called the apex of the conch or true shell. Among nautiloids this was a short living chamber occupied by the body of the animal, but having no siphon or septum. It was completed by the deposition of the apical plate, which sealed up the aperture of the protoconch, thus closing the opening, and cutting off communication between the two interiors. This stage can therefore be named the 'asiphonula' or siphonless larva.

The second larval stage in *Nautiloidea* was composed of a living chamber, closed apically and completed by a single septum, which had a cæcal prolongation reaching across the first air-chamber and resting upon the inner side of the cicatrix. It is proposed to call this stage the 'cæcosiphonula,' since it is undoubtedly the primitive stage of that organ. The cæcosiphonula may indicate the former existence of an ancestral form having a central axis composed of similar closed funnels or cæcal pouches.

The third silphologic stage in nautiloids was completed by a septum (the second in the apical part of the shell) having an open funnel extending apically and joined to a loose-textured siphonal wall which reached down into and lined the cæcum, thus forming a secondary closed tube. In accordance with the structure, this has been named the 'macrosiphonula.'

The fourth larval stage of the nautiloids was completed by the building of the third septum. This septum had a long funnel and attached porous wall, but this wall formed a true siphonal tube opening apically into the next section, the macrosiphon. This was the beginning of the small siphon, and can be appropriately termed the 'microsiphonula.' The microsiphonula was the typical stage of nearly all the known genera of nautiloids, beginning with the *Orthoceratites* of the Cambrian, and found at the present time in *Nautilus*, and also of all ammonoids and belemnoids without exception.

It has also been found in tracing the descent of forms within sub-orders, families, and genera, that it is practicable to prove, that characteristics usually appear first in adult stages, and are then inherited at earlier and earlier stages in successive species of the same stock, whether they occur on the same horizon or in different horizons. The adolescent stages are therefore of as great importance for tracing the genealogy of small groups as are the silphologic characters in larger groups. Thus one can speak in definite terms of the relations of the nealogic (Νεαλής, 'youthfulness') stages, and their meaning, and importance in tracing the genealogy of families and genera, without danger of confusing them with the characters of any of the silphologic stages.

After the silphologic and nealogic stages have been disposed of, there still remains the adult period, which is equally important in genealogical investigations, since it enables the observer to study the origin of many characters which afterwards become silphologic and nealogic in descendant forms.

The use of a distinct term for the adult period becomes necessary not only on this account, and to separate its relations from those of preceding periods, but also because of the constant recurrence and importance of representative forms. The term 'ephebology' ("Εφηβος, 'the age of puberty') has accordingly been adopted for the designation of the relations of the adult stages, and under this term can be classified also the representation of similar forms in different groups or morphological equivalents. These are often so exact that it becomes very difficult to separate them. They have been and will continue to be the most difficult and misleading obstacles to the student of genealogy and classification.

In former essays the senile transformations and their correlations with the degraded forms of the same groups have been described and defined by the term 'geratology' (Γέρας, 'old age').

There were two stages of decline or old age among ammonoids. The first of these is the clinologic (Κλίνω, 'to incline downwards') stage. This immediately succeeded the ephebolic stage, and during its continuance the nealogic and ephebolic characteristics underwent retrogression. Ornaments, spines, and sutures degenerated and lost their angularity; the ribs or pilæ, and often the keel and channels, when these were present, became less prominent; and before this period closed, the whorl itself sometimes decreased; showing that degeneration in the growth-force of the animal had taken place. In man the baldness of the head, loss of teeth and resorption of the alveoli, loss of the calves and rotund stomach, and return of early mental peculiarities, are phenomena of similar import.

The last changes in the ontology of the animal took place in what can be called the 'nostologic' (Νόστος, 'a return') stage, and during this period these tendencies reached their highest expression. Among ammonoids the ornaments were all lost by resorption, the whorl became almost as round and smooth as it was in the silphologic stage, and in extreme cases it even separated from the next whorl, leaving a perceptible gap. This almost complete reversion to the aspect of the silphologic stage can of course only occur in animals which attain an extreme age.

[1] Address at the American Association by Alexander Agassiz, vol. xxix. 1880, p. 410 reprint, p. 22, shows that there is a stage of the embryo common to all orders of living *Echinodermata*. This stage, however, was not named in the address above quoted, which was intended as preliminary to an illustrated essay on the same subject; and Mr. Agassiz has supplied that omission in the following note, which I quote from a letter to me: "I intended some time, when revising my 'Address on Paleontological and Embryological Development,' to call the earliest common stage of echinoderm embryos, 'Echinula,' for convenience in making comparisons. — A. AGASSIZ."

MENTAL SCIENCE.

Aphasia.[1]

IN 1861 Broca suggested before the French Society of Anthropology that the only method of determining the functions of the brain was to co-ordinate marked symptoms during life with the lesions found in a post-mortem examination. Some months later he announced his belief that the third frontal convolution of the left hemisphere of the brain was the seat of spoken language, and described a case of a patient called 'Tan' because that was the only word he used, helping himself out with various gestures. He had no paralysis, and seemed to understand what was said to him. The posterior half of the second and third left frontal convolutions of the left hemisphere was the seat of the organic lesion. In the same year a quite similar case of a man with only such scraps of words as 'oui,' 'no,' etc., but with mental and motor powers intact, showed in the autopsy a definite lesion in the third frontal convolution of the left side of the brain. These remarkable cases drew attention to diseases of this kind; and in the end of 1863, eleven cases were on record in which the power of vocal speech was almost or entirely lost, the common anatomical element of each of which was a lesion in the posterior third of the third frontal convolution of the left hemisphere. Broca called this condition 'aphemia,' and gave as its symptoms the loss of the power to express ideas by vocal movements without any motor paralysis or mental impairment. He concluded that memory was not a single

[1] Abstract of an address delivered before the Anthropological Society at Paris by M. Mathias Duval, *Revue Scientifique*, Dec. 17, 1887.

faculty, but that the memory of each kind of mental acquisition was separately organized, and that the cerebral seat of the memory for motor speech-signs was in the third frontal convolution of the left half of the brain. The most startling fact about this discovery was the association of the malady with a lesion in the left half of the brain only. Broca explained this by taking into consideration that we were all organized with a preferred side of the body, and that to be right-handed means nothing else than to have one's best-developed motor centres in the left half of the brain, inasmuch as the fibres cross over in their descent from brain to muscles. In the same way our speech-movements get associated with the left hemisphere; and in left-handed persons the reverse condition may be expected to occur, and has since been found.

Trousseau substituted the word 'aphasia' for the disease, leaving Broca's term to denote that particular form of it which he brought to notice: for it was soon afterwards observed that with the loss of speech sometimes went the loss of writing as well, and sometimes not; that, again, the power to write may be lost, and that of speech retained. Other patients could speak and write, but not read; and others, again, could read, but not speak or write. A complexity of symptoms variously combined have arisen in which order is now to be put. Four types can be distinguished: —

First Type. — In describing such types, it should be noted, general and typical symptoms alone can be noticed. The patient, perhaps as a sequence to an apoplectic stroke, sinks into a condition apt to be mistaken for a condition of deafness and idiocy; but careful observation soon shows that he is sensitive to noises, such as the opening of a door, and even hears the sounds of the human voice. Inferring that he is spoken to, he may attempt to answer, but will say something entirely irrelevant. Gradually appreciating that he is not speaking to the point, he may with some impatience ask you why he cannot understand what you say. He thus shows his ability to express his thoughts, to hear perfectly, and, besides, he reads and writes, plays chess, and is able to do every thing but understand spoken words. Your speech is as an unknown language to him, — just so much sound. What he has lost is the power to get meaning out of sounds; the slowly acquired associations between the word-sound and the idea are broken down; his memory for word-meanings is lost. He is not deaf to sounds, but deaf to words, — a 'verbal deafness,' as it is called. We have thus a memory for the meaning of the sounds of words, having its centre in the first temporal convolution of the left half of the brain, and losing its function when that region suffers degeneration.

Second Type. — Here, again, the cause may be an apoplectic stroke, which, after the immediate effects have passed off, leaves the patient in an apparently normal condition. He may prepare to attend to his business affairs; will perhaps sit down to write a letter; does so, and, remembering that he omitted something, takes the letter out to read it again. To his surprise, he cannot do so. He takes out his account-books, and finds he cannot read them; he picks up the newspaper, and again it says nothing to him. This patient hears, understands, and speaks: he is not aphemic in Broca's sense. Moreover, he can write; but his writing shows that it was written as though writing in the dark, guided by the muscle-feelings of the hand alone. He cannot read what he has just written, nor can he write from copy. His own name, that has been well impressed upon his motor centres, he writes very well, but he cannot read it. A book or a manuscript is to him as though it were written in Chinese. The disease here, then, is in the loss of the memory for the visual word-signs: the patient is not blind, but 'word-blind.' The remembrance of the forms of letters as retained by the movements executed in making them is intact, the lesion being a purely visual one. The brain lesion in such cases is quite definitely made out. It is in the second parietal convolution or inferior parietal lobule, behind and above the lesion in word-deafness, and, like it, is confined to the left hemisphere.

Third Type. — Here the patient can speak, can read manuscript or print, but he cannot write. He takes the pen in hand to write a word, knows what he ought to write, how it would look if written, but he cannot write it. He has lost the memory of the movements necessary to form the letters. The association between the movements made in writing and the word has been lost. He is not word-blind or word-deaf, but the *motor word-sense* is defective: he is 'agraphic,' as the term goes. A more careful observation shows how closely his malady is limited to this loss. He can use his hands dexterously for all other purposes; he can even draw and copy from a drawing. He can in this way copy script or print, but he draws the letters slowly, as we would copy a Chinese word. We see, then, that the auditory, the visual, and the motor elements of the word are to some extent independent, and that the memory for one of these may be lost while the others are retained. We may expect to find a localization for the motor defect, as for the others: but, owing to the fact that the disease seldom occurs without other complications, the localization is not as certain. Yet the bulk of the evidence points to the posterior portion of the second frontal convolution as the centre disturbed in aphasia. The lesion is again confined to the left half of the brain, and, to complete the connection of this with the phenomena of right-handedness, such patients can learn to write with the left hand by submitting themselves to a process similar to that gone through with in learning to write in youth. They thus cultivate the right hemisphere of the brain.

Fourth Type. — This is the type described by Broca as aphemia, and now called motor aphasia. The loss here is the link between the idea and the appropriate movements of tongue, etc., necessary to make the sounds of words. Often the patient retains a few phrases used on all occasions: in one case it was 'cousisi,' in another 'monomomentif.' The poet Baudelaire, when thus affected, would constantly say 'cré nom.' Here the power of hearing and understanding is retained, writing and reading are intact, and speaking alone has dropped out. The lesion is in the third frontal convolution, mainly the posterior portion, of the left side of the brain.

These pathological states suggest that individual differences with regard to the prominence of these several word-memories in our minds should be discoverable, and that the brain-centre corresponding to the preferred memory should be more highly developed than the others. It has often been observed that to many persons the eye is the chief avenue of knowledge. Extreme instances of this faculty, such as artists copying portraits from memory, and calculators doing their work upon an imaginary blackboard, are well known; but, confining ourselves to the memory for written or printed words, we find an excellent type of this faculty in a case recorded by Charcot. A gentleman of great culture and experience had the power of reading pages of his favorite authors from the visual images of the printed page. Two or three readings of a passage were sufficient to fix it in his memory. If he wanted a letter in a voluminous correspondence, he at once thought of its appearance; and so, too, with regard to all visual experiences in general. For music and other auditory occupations he had no taste. The importance of the case is doubled by the fact that through disease this faculty was lost, and he had to resort to his auditory memory, and cultivate it by having things read to him, and in other ways. He could not remember what he had seen, be it words or other objects; and, in short, from being a 'visual-worded' and 'visual-minded' man, he was forced to become an 'auditory-worded' and 'auditory-minded' one. This type of mind is common, and many persons have the habit of seeing the picture of the page from which they quote, the appearance of their manuscript, and so on. Unfortunately we have no autopsies of normal persons who had been marked cases of this type, to see whether in them the second parietal convolution was especially developed. Passing to the auditory type of mind, one could again easily find extreme cases, and note many instances in which what is heard, and especially in words, is most readily and deeply impressed. Persons to whom writing is easier than speaking, whose thoughts flow off the end of their pens and not of their mouths, may be classed among the 'graphic-motor' type. Deaf-mutes are apt to develop this faculty in another direction, and think in terms of hand-movements. There remains the 'motor-verbal' type. Stricker describes himself as of this type, and tells how he thinks in terms of the muscle-feelings in the organs of articulation. Such persons talk to themselves when they think, and are well represented by a character in a French tale, who could not compose unless imagining himself formally delivering what he was dictating. Unlike the other cases, there is here some anatomical corroboration; and a collection of the brains of lawyers, statesmen, and others, all celebrated for the fluency of their speech, shows a surprisingly large development of the third frontal convolution of the left hemisphere. The brain of Gambetta is a marked instance of the same fact. Here this convolution is so highly developed that it is actually doubled by a slight fissure in the middle, no trace of this development being found on the right side.

What is above described includes merely what is most surely and definitely known, — a vast field for future research remains open, and even now enigmas are waiting to be answered. That certain aphasic patients are unable to count, and others do so normally; that some can tell time, distinguish the beats, but cannot count; and so on, — are facts as yet without meaning. So, too, the loss of the power to express one's self in gestures, and to use the ordinary conventionalities of life, may some day find a definite cerebral localization. Sometimes only certain kinds of signs are lost, and the rest retained; sometimes the patient can talk only by singing. All these facts may, in the science of the future, be as definitely explored as the main types of aphasia are to-day.

THE PSYCHOLOGY OF HANDWRITING. — In the *North American Review* for January, the editor, Mr. Rice, prints a series of the autographs of Napoleon, written at various epochs in his eventful life. Starting in his earlier years with a bold and clear signature, it retains most of these characteristics in the days of his greatest successes; but parallel with the declining fortunes of the great man, is a degeneration of his autograph, until at the end we have nothing more than the rudest, characterless scrawl. The autographs cannot but suggest the ravaging changes in the nervous system that were the physiological concomitant of the turmoil raging in the hero's mind.

HEALTH MATTERS.

Foot-and-Mouth Disease, and its Relations to Human Scarlatina as a Prophylactic.

AT a recent meeting of the New York Academy of Medicine, Dr. J. W. Stickler of Orange, N.J., read a paper entitled 'Foot-and-Mouth Disease as it affects Man and Animals, and its Relation to Human Scarlatina as a Prophylactic.' He said that it had long been known that foot-and-mouth disease could be communicated from animals to man through the milk of the affected animals, and by the introduction of the virus into wounds. When human beings are the subjects of this disease, the glands become enlarged, vesicles appear in the mouth and upon the hands and feet, and in some cases an eruption which resembles that of scarlet-fever. Hertwig and others, who purposely contracted the disease by drinking infected milk, were affected in this way. In 1884 there was an epidemic of sore throat, together with glandular enlargements and vesicles, in Dover, England. Upon investigation it was shown that it was due to the drinking of milk from animals sick with foot-and-mouth disease. Two years after this, an investigation was made in one hundred and eighty-two of the cases which had suffered from the sore throat in 1884. None of them had since had scarlet-fever, and from other points in their history it appeared that they had been rendered insusceptible to that disease. Dr. Stickler had himself inoculated three children with virus from milch-cows, and subsequently exposed them to scarlet-fever. One of these, after having fully recovered from the inoculation, was taken to the bedside of a scarlet-fever patient, and inhaled the latter's breath, and placed his head upon the pillow of the sick one. The child did not contract the fever. Two other children, similarly inoculated and similarly exposed, have not contracted the disease. In concluding his paper, Dr. Stickler said, that, while it was by no means proven that scarlet-fever could be prevented by such inoculations, the results thus far obtained were very suggestive, and proposed to continue his investigation.

In the discussion which followed the reading of the paper, Professor Law of Cornell University said that he was sceptical as to the prophylactic value of these inoculations against scarlet-fever. In Great Britain there were frequent outbreaks of foot-and-mouth disease, affecting cattle and the persons who came in contact with them, and, if it was a protective disease against scarlet-fever, he thought the latter should be much less prevalent than it was. He had himself been over and over again exposed to foot-and-mouth disease, but had never suffered, while, on the first exposure to scarlet-fever, he contracted it; his system being susceptible to the one, and not to the other. He thought it would be dangerous to investigate this subject very much in the United States, as it would be a very serious matter if the foot-and-mouth disease should be introduced among American cattle. He also feared that scarlet-fever might be more widely disseminated if these inoculations were to be made general. While he had great respect for Pasteur, he could not help believing that he had increased the spread of anthrax by scattering abroad his modified anthrax virus, as, under favorable conditions, this weakened virus might become potent and dangerous. He considered it a fact that there had been more rabies in England since Pasteur's discovery than before; and the same danger existed in the attenuated virus of rabies as in that of anthrax.

Dr. L. McLean of Brooklyn said that there was no such natural disease as bovine scarlatina. If cows contracted the disease, it could only be by inoculation from affected human beings. He did not believe that foot-and-mouth disease was prophylactic of scarlet-fever. There had been but two outbreaks of foot-and-mouth disease in this country, — one in Maine; and one in the vicinity of New York City, extending up the Hudson as far as Poughkeepsie.

Dr. J. Lewis Smith said, "Since the time of Jenner the hope has been awakened that some of the other fatal infectious diseases, and especially scarlet-fever, might be prevented, as small-pox has been, by the substitution of a milder and modified disease, derived from the lower animals. As regards scarlet-fever, two propositions of great interest and importance have arisen: first, is there a disease in the bovine race which is true scarlet-fever, or which communicates genuine scarlet-fever to man? and, second, if there be such a disease, does it produce a mild and modified form of scarlet-fever in man? Many instances have been recorded in the last five or six years in which epidemics of scarlet-fever have arisen from the use of milk furnished by healthy cows, and infected with the scarlatinous germ after the milking; but in the St. Marylebone and Hendon epidemic, occurring two years ago, and described in the *British Medical Journal*, May 20, 1886, the outbreak of scarlet-fever appeared to be clearly traced to diseased cows. Now, the point to which I wish to call attention is this. The sickness of the cows was mild, not appreciably impairing their appetite, nor diminishing their milk, but the disease which the use of the infected milk produced is described as an 'intense outbreak of scarlet-fever.' Instead of a mild disease being propagated from the cow, for which we are looking and hoping, the reverse occurred. A mild form of the disease in the cow produced a severe one in man; so that it appears from the history of this epidemic, that, by inoculating with the bovine scarlatinous virus, we might produce severe and fatal epidemics, instead of a mild and modified form of the disease."

Dr. Stickler closed the discussion by saying, that, if he produced only a slight and harmless attack of scarlatina by his inoculations, he could see no objection to the use of the scarlatinal virus for this purpose; and, when the terrible effects of the unmodified disease were taken into consideration, he thought it of extreme importance that a method of protection should be secured if possible. As to the disease from which the Hendon cows suffered, it had, he thought, been clearly demonstrated that it was nothing else than scarlatina, since it was precisely the same affection as was ordinarily produced in cows by the inoculation of scarlatinal virus from the human subject.

THE BACILLUS OF CANCER. — Dr. Horatio R. Bigelow, in a letter from Berlin to the *Boston Medical and Surgical Journal*, expresses his conviction that Scheurlen has discovered the bacillus of cancer. This discovery is confirmed by S. Guttmann and Stabsartz Schill. In every case of cancer which Scheurlen has examined, he has found the bacillus. Dr. Bigelow believes that there is a bacillus of cancer just as really and absolutely as there is one of consumption. Its morphological characteristics are not yet clearly defined, and there are many other doubts to clear up and questions to answer; but all of this can come only after many months of hard and patient labor. At a recent meeting of the Berlin Society of Internal Medicine this discovery of Scheurlen was discussed. Fraenkel regarded the methods employed by

Ethnological Map of Southeastern Europe.

According to H. Kiepert.

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Scheurlen as defective. From the reports of this meeting it would appear that but few of the leading men of Germany are yet ready to accept Scheurlen's claims as established.

BOOK-REVIEWS.

Lectures on Bacteria. By A. DE BARY. 2d ed. Tr. by Henry E. F. Garnsey and Isaac Bayley Balfour. Oxford, Clarendon Pr. 8°. $5.50.

THIS is an excellent translation of De Bary's 'Vorlesungen ueber Bacterien,' with a considerable number of notes in an appendix. For one who wishes a good readable account of the nature and action of bacteria, not too long or too full of technical details, this moderate-sized and well-arranged volume answers the purpose admirably.

The Children: How to Study Them. By FRANCIS WARNER, M.D. London, Francis Hodgson. 12°.

THIS little volume contains half a dozen lectures, delivered by request of the Froebel Society of London, by Dr. Warner, whose works on the anatomy of movement and on physical expression are widely known. The object of the lectures is to impress upon teachers and parents the necessity and importance of the scientific observation of children. The plea is admirably and emphatically urged. On the practical side there is an attempt to give a number of indications by which the physiological health and growth of children can be observed. Though these are doubtlessly useful, and when made by a skilled observer valuable, yet they are too vaguely stated to be generally applicable. A table of printed questions, with directions as to their use, would be a much safer and more useful compend to put into the hand of the ordinary teacher. Dr. Warner sketches the anatomy of the parts of the body concerned in motion, shows how they are all related to the activity of the brain, and thus become an index of mental strength or weakness, and then describes a series of postures of various parts of the body, and especially of the hand, indicative of various temperaments. He lays stress upon the indications of the nervous type of child with the practical object of teaching such children separately, as we do with the deaf, the blind, and the weak-minded. "Why, then, are the children of slight brain-defect not specially cared for, children tending to become passionate picking up bad habits and practising them, tending to criminality, or, if too feeble for that, to pauperism? . . . Now, my argument is, that we can discover such children and pick them out in a school by definite physical signs; we can point out the children not up to the average, and tending to failure from want of brain-power." This series of lectures adds to the number of indications of the time when we shall have definite knowledge of the physical and mental traits of children by which their healthy education may be guided, and their evil tendencies avoided.

Annual Report of the Geological Survey of Pennsylvania for 1886. Parts I. and II. Harrisburg, Geol. Surv. 8°.

ALTHOUGH Professor Lesley's staff is now quite small, this report adds four volumes to the imposing series already published by the Second Geological Survey of Pennsylvania. Many of these numerous volumes, although possessing a local interest and value as aids in economic developments, are, from the scientific point of view, simply masses of facts awaiting generalization; and it is to be hoped that the long-promised final report which is to co-ordinate these multitudinous data will soon begin to appear.

Only the first two volumes of the report for 1886 have been received. These are crowded with details of the development and production of coal, oil, and gas, but are rather deficient in features of more than local interest not previously published; and, since the data are largely of a statistical nature, even their local value must be diminished by tardy publication.

The first volume contains the report, by Mr. E. V. d'Invilliers, on the re-survey of the Pittsburg coal-region. It is largely a summary, in one volume, of the surveys made a decade since by Professor Stevenson, Mr. White, and others. It is accompanied, however, by a new geological map of south-western Pennsylvania. Special attention is given to the principal commercial coal of the region, — the great Pittsburg bed. Its outcrop is determined horizontally and vertically more accurately than ever before; and the historical and statistical facts bearing upon its development, the structural lines affecting its position for mining; the stratigraphical features of the coal-measure systems above and below it; and the methods most in use for mining and transporting its product to market, — are exhibited in all desirable fulness and detail. It is easy to see that this report must prove of great practical utility to the coal-operators of the region; and the elevations above tide of the outcrop of the Pittsburg coal-bed will be useful to oil and gas prospectors in giving them a basis from which to estimate the depth to be drilled in order to reach the geological horizons of the different oil and gas sands.

This report is supplemented by two important contributions on Pennsylvania bituminous coal mining by Mr. A. N. Humphreys and Mr. Selwyn Taylor, and is also accompanied by a memoir by the eminent and venerable paleo-botanist, Leo Lesquereux, on the character and distribution of paleozoic plants.

The second volume consists chiefly of Mr. Carll's report on the oil and gas regions. The history of development is the most complete yet published, and gives the reader a good general idea of the successive steps by which the petroleum industry has advanced from the primitive skimming of an oil-spring with a piece of bark and the restricted use of the material to medicinal purposes, to the drilling of wells three thousand feet deep, the pumping of oil over mountain and valley to the seaboard, and the flooding of the world with an inexpensive illuminant. The ancient pits or shallow wells which are found all over the oil-region, and which were undoubtedly dug to obtain oil, are discussed at some length; and the conclusion is reached that these early oil operations are due, not to the Indians, or French, or early white settlers, but to some primitive dwellers on the soil, who have long since passed away.

Short chapters on the geographic and topographic distribution of oil and gas, on the structure and stratigraphy of the productive horizons, and on the developments during 1886, are followed by a long and monotonous series of well-records, which constitute the principal part of the report. The volume concludes with a memoir on the chemical composition of natural gas by Professor Phillips, and the extended bibliography of petroleum.

Unfinished Worlds: a Study in Astronomy. By S. H. PARKES. New York, Pott. 12°. $1.50.

THIS book is intended for general readers, especially those in early life, whose ideas of the province and achievements of science are generally in excess of the sober teachings of actual experience. In this we quote from the author, and, while we are ready to agree with him to a large extent, yet we feel that just as the knowledge of Columbus seemed wonderful and awe-inspiring to his crews when he predicted the coming of an eclipse, so to us appear startling the little scraps of information our new instruments are giving us of the constitution of the celestial bodies. The old astronomy busied itself with the movements, the new astronomy with the physical constitution, of the sun, the stars, the planets, and comets. While it is true that for many of us the interest in the old astronomy began to wane, the results already achieved in this new field are so novel that we may be pardoned if we are apt to exaggerate their magnitude. Mr. Parkes's book has for its main purpose the bringing-out clearly of the changing nature of the bodies filling space, and sketches the information we have of nebulæ, stars, the sun, the earth, the planets, and comets. All this is well done. The book closes with a *résumé* of the different cosmic theories.

NOTES AND NEWS.

THE January number of the *Revue Philosophique*, edited by Felix Alcan, contains articles by A. Espinas on the mental evolution of animals, by F. Paulhan on associationalism and psychical synthesis, and by Adam on Pascal and Descartes. Besides this, reviews and *résumés* of new publications are given.

— Prof. J. J. Egli of Zurich, Switzerland, who writes the biennial reports of new researches on geographical names for Wagner's annual report on the progress of geography, publishes a circular letter in which he requests authors and publishers to send him copies, or, when such is not possible, titles, of publications and of notes or papers in journals or books referring to the subject of goegraphical names, their meaning, origin, derivation, etc. As it is desirable that the annual reports should be as complete as possible, and as a large amount of material is scattered through American journals, and particularly through the publications of the State surveys and historical societies, which are difficult of access in Europe, American authors can materially help Professor Egli by sending him copies, or at least the titles, of their remarks bearing on this subject.

— Last autumn an attempt was made, says *Nature*, to bring live cod from Iceland to Norway on board smacks, and six thousand fish were brought over to Bergen successfully. Here, however, many of them died, on account of the basin in which they were kept until the sale could be effected being too small. This year fresh attempts will be made.

— Dr. Asa Gray has been seriously ill for some weeks.

— The second meeting of the International Copyright Association was held in Boston, Jan. 24, President Eliot in the chair. Secretary Estes announced that satisfactory progress had been made in the movement to obtain the recognition of authors' rights in their literary work. A resolution was adopted approving the principle involved in the amendments of the Chase Copyright Bill proposed by the executive committee of the American Copyright League and the American Publishers' Copyright League, and requesting Senator Chase to adopt these amendments, with such verbal changes as may be recommended by the council of this association and adopted by the committees mentioned. A resolution was also passed asking the chairman to appoint a sub-committee to confer with Senator Chase regarding these amendments. After a general discussion, in which Messrs. Houghton, Scudder, Ticknor, Ernst Lothrop, and others participated, the meeting adjourned.

— *Nature* comments on French architects as seeming to attend to the decorative rather than the useful parts of the buildings they design. The architect who designed the new medical school in Paris took so little pains about the distribution of the water-pipes, that in very cold weather the laboratories (chemistry, physiology, bacteriology, experimental pathology, etc.) are wholly deprived of water. Recently the water in all the pipes was frozen, so that not a drop of water was available in a single laboratory. Of course, every one connected with the school complains that work under such conditions is nearly impossible. The new Sorbonne will be a handsome building, but, unfortunately, the work is soon to be stopped owing to lack of money. The ornamental part of the building is finished, but the useful part has not yet been begun.

LETTERS TO THE EDITOR.

*** *Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

Twenty copies of the number containing his communication will be furnished free to any correspondent on request.

The editor will be glad to publish any queries consonant with the character of the journal.

The Snow-Snake.

IN a letter (*Science*, xi. No. 259) pointing out certain errors in an article on Pocahontas, referring especially to two games mentioned therein, Dr. Beauchamp says, "The children indoors were playing at *gus-ha'-eh* (or 'peach-pits'), it is said; but where the peaches came from at that early day is not explained." Yet the doctor fails to give us a hint as to the true rendering of this word, and the proper name of this game. This game was played generally with 'plum-pits,' though sometimes with small pebbles, etc.; but, as the pits were more convenient and symmetrical, they were preferred, and, being used in most cases, they gave their name to the game, namely, 'plum-pits,' or, better, 'pit-betting.'

In regard to the use of the snow-snake among Powhatanic tribes, Dr. Beauchamp remarks that "it is not wise to place a Northern game so far South," evidently wholly oblivious of the fact that 'betting' with the *u-tră-hwĕⁿ'-uĕ* ('snow-snake') was a favorite outdoor sport of the Carolinian and Virginian tribes of Iroquois, — too important offshoots of the family to be overlooked, — and who were situated farther South than the Powhatans. The doctor should have omitted the *r* in his orthography of the word *kă-wher'-ta* (*kă-whe'-ta*), as it does not occur in the speech of the Onondagas of the present time. J. N. B. HEWITT.

Washington, D.C., Jan. 23.

The 'Act of God' Once More.

MR. W. W. Nevin's interesting note (*Science*, Dec. 2) as to the Mexican doctrine of 'fuerza mayor' emphasizes my point. The Roman law having always been, as it still is, the law of continental Europe, it was inevitable that such American colonies as were settled from the continent should retain the doctrine of the 'act of God,' and that when the Spanish brought it to Mexico, and implanted it in a community saturated with superstition, it should have augmented quite as rapidly as its adumbration has waned with us, until even so anticipated an occurrence as the flooding of a river in a rainy season should relieve from the obligation of a contract. But United States capital and energy are speedily civilizing Mexico by building railroads within her territory, and doubtless we may expect a very considerable attenuation of the doctrine at no distant day. I do not think all of *Science's* correspondents share in the good faith of Mr. Nevin. It does not impress me, for example, as in good faith that one of them asks (*Science*, Nov. 25) whether, had a certain car-stove he specifies upset and ignited a certain train, it would have been an 'act of God;' or that another (*Science*, Dec. 16) demands whether I propose that the railways of this Republic be operated by Mexican law. But in good faith, nevertheless, will I answer both these questions. Up to the date of the latest of the five accidents I specified, no practicable means of heating cars had been invented except car-stoves. Steam-pipes from the engine had, indeed, been proposed for twenty years, but no coupler-joint had been perfected, and no means of keeping the steam from cooling, sufficient to overcome the extreme coolable surface of a pipe serving long trains in the severe weather of the mountains, or the low temperatures of the North and North-west, devised. At present, however (stimulated, in fact, by the very casualties I specified at Republic and White River), there are certainly three or four of these contrivances which have been tested and found practicable. Therefore, had your correspondent's stove overturned and partially roasted him, he would certainly have been deprived of the opportunity of asserting that he had been roasted by an 'act of God,' since the company could have availed itself of that particular progress of applied science which had invented a heating apparatus which in case of accidents would not induce combustion of the train. As to the second question, I say, No, and Yes. I proposed no Mexican laws for regulation of our own railroads, but I did question whether an already well-known rule of law limiting the responsibility of the employer for mental conditions of the employee was entirely without bearing upon a certain state of admitted facts. The common law expressly declares that there are possible conditions of an employee's mind which discharge the employer. An employee who, in ejecting trespassers, becomes vindictive, passionate, or wilful, and on that account employs a surplusage of force, so acts at his own and not at his employer's peril. I therefore suggested a question whether an entirely unforeseen and instantaneous absence of mind on an employee's part was any more within his employer's control than a burst of passion.

Again: it seems immaterial to my point that different investigators, tribunals, or commissions may receive different reports of the causes directly forwarding a casualty. A question of precedence between parallel proximate causes is always an exceedingly nice one. Indeed, the only report of a railway accident likely to be substantially unreliable is the newspaper report; and this not necessarily because the newspaper is biassed against the company, but simply because newspapers are at the mercy of their reporters, precisely as railway companies are at the mercy of their employees. The reporter first on the ground takes the impressions of the bystanders, and reconciles them somehow out of his inner consciousness. The only persons present who possess the slightest actual knowledge as to the why and wherefore of the catastrophe are the employees of the company, and they are silent. They have their duties none the less rigid in case of accident than when all goes well, and are at their posts, saving life and property, and preventing further destruction by signals, and have neither the time nor the right to instruct reporters; though, I may add, their silence is always taken as a final confession of guilt on the part of the company. Indeed, on reading the average American newspaper accounts of railway disasters, I have repeatedly found myself exclaiming, "Why did not this dastardly and murderous company complete the catalogue of its crimes by braining the survivors with crowbars, and adding to its ill-gotten wealth by impartially pillaging the dead bodies of all its victims?" I once had occasion to investigate an accident which derailed a way-train, throwing it over the double track and immediately before an express-train coming in the opposite direction, almost exactly upon the time when the express-train was due at the point where the derailment occurred. Upon the trial of a resulting lawsuit, the crew of the wrecked train testified unanimously to the fact: the company's time-table and the registers of the train-despatchers at both ends of the division (which could not have been disturbed without throwing the whole business of the road into chaos) proved it. But some passengers whom the unusual sensation of escaping from destruction had unnerved, and to whom a series of crowded and unique experiences had made a few moments seem like hours, testified that there had been ample time to flag the express-train (some of them putting the interval at several hours); and the jury unanimously believed the passengers as against the company's witnesses, and thus morally convicted the employees of perjuring themselves under orders, in order to mulct a corporation in damages. Juries from the interior do these things as regularly as the opportunities present themselves; and the excuse lies, not in the opportunity, but in the nature of things, and in the axiom that 'bigotry' and 'ignorance' are synonymous terms. But unfortunately there is no such palliation or excuse for the ready writers and composers of leaders on the staff of our great newspapers: for these are cultivated gentlemen, who know perfectly well that railway corporations avoid accidents as they avoid bankruptcy, and enforce a ceaseless and enlightened vigilance to prevent them; that railway companies do not practise small economies, do not risk bankruptcy (for a single great accident, like that at Revere, may bankrupt, as that one actually bankrupted, an entire corporation) for the sake of a few dollars, yet, knowing this, persist in telling the public that railways are careless of public rights, and indifferent to human life. To be sure, these gentlemen do not second the religious press in advising that locomotive-engineers and East River pilots read their Bibles when on duty, — a habit which would doubtless largely increase the perils of steam-transportation; but they often, as we shall see, make suggestions quite as invaluable.

On the evening of Tuesday, Dec. 20, 1887, there *was not* a bloody and terrible disaster on the Elevated Railroad in this city. A train packed with human beings *was not* precipitated into a narrow street below, crowded with men, women, and children; horses, trucks, and vans. The wheels of a particular train, upon that occasion, left the track, but the prudence and skill of the builders of the elevated structure vindicated themselves: the jar never deflected it an atom, the stout sleepers held the train, and nobody was scratched. But no one, on reading the leaders printed in the daily newspapers of this city, would have supposed that a terrible calamity had been averted. Had that entire train, full of human beings, been precipitated upon these passing men and women, horses, trucks, and vans, the daily newspapers could not have censured the Manhattan Elevated Railway Company more emphatically than they did; or drawn for the occasion more vigorous and virtuous lessons of the greed of railway corporations, and of the woes of a long-suffering public. While every practical railway man in the country must have admired the perfect and almost automatic construction which saved so much waste of life and property on that occasion, not a newspaper commended the management, but rather took an additional opportunity of vilifying railroads in general, and the Manhattan Railway Company in particular. I did not read all the eloquent leaders with which the press improved the occasion of the non-occurrence of an appalling disaster on the New York Elevated Railroad; but I remember one, that, after feelingly dilating on the ghastly picture of gore and agony which *was not* presented on that occasion, exclaimed, —

"We must require of those who undertake such responsibilities absolute security, not a pretty tolerable degree of safety. It is not enough that accidents shall not be frequent: they must be impossible. The system must be managed on the principle that there are no railroad accidents; that what are called such are due to some species of neglect, which truly competent management could and would have prevented" (*Commercial Advertiser*, Dec. 22, 1887). If the gentleman who wrote those words will continue to walk uprightly and piously before men unto his life's end, will read his catechism and endeavor to reflect its precepts in his daily gait and conversation, he will doubtless eventually proceed to a vicinage beyond this fitful fever of life where accidents are 'impossible.' I doubt if he finds it upon this poor planet. But, although perfectly innocuous to those as clever as himself, is it not manufacturing a dangerous public sentiment — and one as unpatriotic as it is dangerous — to constantly kindle and fan the impression, that, of all the necessary industries which civilization requires, the industry of maintaining a railway, or any thing that runs by steam, is a greedy and despotic power, that lives by crushing not only the bones of passengers, but the civil liberties of the people? If it is, and if it is wrong to do dangerous and unpatriotic deeds, then the gentlemen who write these feverish and furious leaders — unless they repent — will certainly never behold the land where no accidents happen. I may add, perhaps, as germane to my text, that the newspapers all appear to agree, that, if nobody was killed the other evening at Franklin Street, it was not the fault of the Manhattan Elevated Railway Company, but a genuine 'act of God.'

"In a recent number of *Science*," says the *Evening Post*, "Mr. Appleton Morgan has published an article, entitled 'The Act of God and the Railway Company,' in which he tries to palliate or even to deny the responsibility of the corporations for most of the serious railroad accidents of the past year. We have of late become quite accustomed to such pleas on behalf of the Anarchists; but when the same line of argument is invoked in favor of a railway company, by a lawyer of Mr. Morgan's standing, it is a surprise, and by no means a welcome one." I myself do not see what I have to do with the Anarchists, or the Anarchists with me. An Anarchist is one who intrudes upon the still unsettled problem of labor *versus* capital, and proposes solving it by eliminating the element of labor, and substituting cataclysm therefor. The idea of cataclysm may have suggested a railway accident, otherwise the *Post's* correspondence of ideas does not impress me as important. Proceeding: the *Post* is astonished that I should have given an account of the Forest Hill disaster at variance with the official report of the Massachusetts Board of Railway Commissioners who investigated it, saying, "We do not understand how it was possible for a writer of good standing to disregard these facts. Either he must have presumed on the ignorance of his readers, or else he never took the trouble to look into the matter itself. The latter is perhaps the more charitable supposition. But it need hardly be said that for a writer in a scientific periodical either excuse is equally weak." Doubtless the *Post* did not, at that writing, understand how anybody could prefer the report of experts to the official reports of non-experts upon so complicated an affair as a railway accident. But it ought to have had some glimmering of an idea as to how such a preference was possible, a day or so later, when itself printed prominently, and without comment, the following item: "After a number of weeks spent in the investigation of the Chatsworth train-wreck, the Illinois Railroad and Warehouse Commission has submitted to Governor Oglesby a report stating, that, in their opinion, the 'train would not have been destroyed if the bridge had not burned before the train reached it.'" Before so masterly an analysis of the casuistry of proximate causes, no wonder the *Evening Post* was speechless. The Illinois Commission found that the Chatsworth disaster would not have happened had the bridge fallen before the fated train reached it. Their Massachusetts contemporaries reported, that, had the bridge-inspector been discharged before he reported the bridge safe, the fated train would never have attempted to run over it. I do not, upon the whole, see much to choose between them. As I write, word comes that the Minnesota Board of Railway Commissioners, as if emulous to compete in usefulness with its compeers of Illinois and Massachusetts, had decreed that no upper berths in Pullman sleeping-coaches must be made up until actually sold to passengers, which would oblige sleepy passengers either to sit up during transit through that intelligent commonwealth, or else sleep with entire indifference to the dusky porter and the possible new-comer, and sundry joint operations not, as most of us know, over-conducive to balmy and seductive repose.

What, then, we really require is not a new law, or a new custom, or a new statute, but an infallible foresight and judgment. Our newspaper leader-writers are not, unfortunately, the only gentlemen in the country who can prophesy things after they come to pass. There are plenty of gentlemen, equally competent in that regard, now employed upon the railway lines of this continent. If, however, a gentleman could be found with the much rarer gift of prophecy as to things to come before they actually transpire, I imagine that it would be difficult to name a salary he could not command from a railway company. Indeed, neglect by a railway company to secure the services of such advance prophet ought certainly to be such a negligence as would settle the company's liability entirely beyond all possible legal inference. There is nothing upon which newspaper comment is more familiar than the well-worn theme of the fallibility of human testimony: even four inspired Evangelists, they tell us, could not agree upon a given state of facts. They press this fallibility against railroad companies. Do they ever press it in their favor? That the average newspaper should experience a difficulty in conceiving that every railway accident was beyond the company's control does not amaze me; but I admit to some surprise at the following criticism upon my paper, in the *Railroad Gazette*, a most valuable and intelligent commentator, usually, upon railway affairs: viz., "At Republic, he [myself] says the man sent with a red light failed to carry it; no mention is made of the fact that two men failed in their duty to send him. Concerning Forest Hill, Mr. Morgan makes the original assertion that no appliance in the company's power to provide was lacking; which, perhaps, must be admitted as true, as a competent bridge-engineer (which the company neglected to provide) could not be called an 'appliance.'" So far from exploding, this appears to me a much stronger putting of my point than I was equal to on the facts as they reached me. According to the *Gazette*, the fault at Republic was not that the one red-light man did not go ahead, but that two officials did not send him. So, not one human brain, but two, failed to do their duty. If, as I argued, a corporation cannot control the deflections of even one human brain, how can it control the deflections, independent and coincident, of two? The fact that one man was absent-minded, I held to be beyond the power of a corporation to prevent. But the utterly unprecedented coincidence of two brains at the same moment, in the same spot, and under the same circumstances, forgetting their duty, — and that duty their identical duty to do identically the same thing, — does really seem to me to be about as nearly an absolute act of God as any case of which most experts could conceive. And, again, supposing that the inspector of bridges of the Boston and Providence Railroad was incompetent: here, again, a human brain was at fault. If it can be shown that the Boston and Providence Company knew him to be incompetent, or had discharged a competent bridge-inspector to deliberately install an incompetent one, that would have been another matter. But it does not so appear, neither does it appear that any bridge inspected by this particular bridge-engineer had previously fallen. Speaking of this unfortunate bridge-engineer of the Boston and Providence Railway Company, the Massachusetts Board of Railway Commissioners says, "This man had been in the employment of the corporation for a long series of years, his trade was that of a machinist, he had not been educated as a civil engineer, and the management had abundant reason to know that he was not qualified, and had had no opportunity to qualify himself, to do the work assigned to him with reference to this bridge." *Ergo*, had he been discharged prior to the accident, the accident would not have happened. Perhaps not. If a railway company could only foresee accidents, could know in advance just exactly when one of its bridges was going to collapse, doubtless it could avert the disaster by discharging the bridge-inspector, so that he could not report that bridge secure, so that no train would try to cross it (which would resemble, indeed, the intrepid mariner who warded off a cyclone by collaring the barometer and holding it upside down). But, seriously, should our railway companies every now and then discharge their old, tried, and faithful employees — men "who had been in the employment of the corporation for a long series of years" — lest they should at some time or other in the future become unfortunate, unfaithful, or careless? Perhaps a man not "educated as a civil engineer" could not possibly, after having been "in the employment of the corporation for a long series of years," come to know as much about railway-bridges as if in his youth he had spent a couple of years with a tutor, or in a polytechnic college. Does not the *Railroad Gazette's* statement of the causes of the Forest Hill accident exactly carry out my own criticism; namely, that a human brain, trusted and unusually accurate, for once failed to do its work?

APPLETON MORGAN.

New York, Jan. 12.

The Pronunciation of 'Arkansas.'

J. OWEN DORSEY'S article in *Science* for Jan. 13, re-opening the question of the pronunciation of 'Arkansas,' necessitates a few words in reply.

I fear that Mr. Dorsey fails to catch the spirit of my plea for the local and historically correct pronunciation, when he dwells upon the various vowel-sounds of *a*, and accuses me of pleading for 'consistency' in the pronunciation of this most inconsistent Anglo-American language of ours. Such an act upon my part would certainly be in opposition to my favorite hobby of observing and collecting data upon the differentiation in orthography, pronunciation, and vocabulary, under climatic and industrial conditions, of the English language in the United States.

The broadening of *a* into *aw*, the Indian origin, and the euphony of the word to foreign ears, are questions of the least import in the pronunciation of the word 'Arkansas;' for the first of these is probably French-Indian or a secondary climatic change visible in hundreds of other words, such as 'W*a*bash,' 'Ouachit*a*,' 'Waukesh*a*,' etc., and which neither Mr. Dorsey nor I, nor any one else, can stop, more than we could put a brake upon any other evolutionary biologic or linguistic process. The evil effect that would follow the use of individual choice in the euphonious pronunciation of geographic terms is self-evident; and, since these Indians had no phonetic method of recording their tribal names, we must seek the approximately correct pronunciation of the word 'Arkansas' in the French language, in which it was first phonetically recorded. Surely, Mr. Dorsey cannot find there any authority for the pronunciation of the final syllable 'saas,' or omission of the final *s*. Certainly none of the examples given by him would authorize this, nor any of the following historical methods of spelling the word, which Mr. Dorsey seems to have overlooked: Joliet (1672), 'Kansa;' Hennepin's map (Utrecht, 1697), 'A Kansa;' Dumont de Montigny's map (1753), 'Arcanças;' Le Page du Pratz (1758), 'Arcancas;' and many other later French writers, 'Arkansas;' all of which, in good French, can only be pronounced 'Arkânsâ.' I think no further examples are necessary to show that the original French pronunciation was much nearer '-sa' or '-saw' than 'saas.'

But this is only one, and the least, of the many reasons why the local pronunciation should be preserved. The present territory of the State of Arkansas was first settled by a colony of Frenchmen, sent out by the celebrated financier, John Law, about the year 1720. They settled in the country of the 'Arkansas' Indians at Arcansas Post, around which their descendants have lived until the present day, and which was the nucleus of all the early Anglo-American migrations into Arkansas, and from whom they got their pronunciation of the French geographic nomenclature. These people still pronounce the word 'Arkân*sâ*' and 'Arkan*saw*.' They can see neither logic nor reason in 'Arkan*saas*.' Nor are they to be blamed that they memorialized the Legislature of the State through the Historical Society of Arkansas a few years since, when exasperated by the attempts of foreign euphonists to force the 'saas' pronunciation upon them, and to ridicule the only historical and phonetically correct pronunciation of the word, to set the matter at rest by legalizing the old pronunciation of the word, which was done by an almost unanimous resolution of the State Senate.

Have the customs and rights of the millions of Anglo-American and French-American pioneers and descendants in this region no voice in the matter of the local nomenclature? Suppose that they, for the sake of euphony, should say that 'Worcester' (Mass.) should be pronounced 'Wor-ces-ter,' or 'Tehuacana' (Tex.) 'Tee-hu-a-can-a,' or 'San José' (Cal.) 'Saint Jo,' etc.: they would be termed ridiculous. If Anglo-Americans should agree to abandon the original pronunciation of all the French and Spanish spelled geographic terms of the South-west, I would agree with Mr. Dorsey, "that, when the regular Indian pronunciation cannot be maintained, let us use one that is euphonic English;" but as long as we pronounce the final syllable of the following partial list of French-American denominatives 'a' or 'aw,' all of which had the same origin and belong to the same category as 'Arkansas,' I shall oppose the singling-out of the latter word for euphonic experimentation: Attakapas, Tensas, Arkansas, Opelousas, Quapaw[1] (Kapas), Chickasaw[1] (Chickachas, Tchicachas).

Now, let us drop the word 'Arkansas' for the present, and take a look into the pronunciation of the geographic nomenclature of the western United States, which had its origin in the romance-speaking people, and its modifications by the Anglo-Saxon migrants, and lexicographers. Mr. Swinburne has given some fine illustrations of this in his able article 'The Bucolic Dialect of the Plains,' in a recent number of *Scribner's Magazine*; but there some general laws can be drawn from my observations in the Upper and Lower Mississippi valley, which I think are worthy of consideration. They are as follows:—

(1) In the north-west, the Latin-American geographic names, or Indian names spelled in the Latin languages, are generally spelled correctly by Anglo-Americans, but often mispronounced. Examples: 'Terre Haute,' 'Detroit,' 'Versailles,' 'Kansas,' 'Vincennes,' etc.

(2) Latin-American names of the south-west, or Indian names spelled in Latin languages, are often wrongly spelled by Anglo-Americans, but usually pronounced with approximate correctness. Examples: 'Bosque' ('Basque'), 'Turn Wall' (rare) ('Terre Noir'), 'Low Freight' ('L'Eau Frais'), 'Boggy' ('Bogie,' proper name), 'Tensaw' ('Tensas'), 'Prairie Dan' ('Prairie d'Ane'), 'Arkansaw,' 'Waco' ('Hueco'), etc.

It seems indeed paradoxical that the best educated and most literate population should have been least correct in the pronunciation; but when it is remembered that the Southern migrants procured their pronunciation by direct contact with the French and Spanish speaking people, and that the Websterian pronunciation was invented far from the scene, and in a day when modern languages received little attention, and the monopolizing classics pronounced even the mother Latin in the euphonious *veni, vidi, vici*, method, it was nothing but natural, that, "while Noah Webster in Connecticut was proposing single-handed to work over the English tongue so as to render it suitable to the wants of a self-complacent young nation," he should have fallen into the error of writing in the former editions of his valuable dictionary, "Arkansas, formerly pronounced and sometimes written 'Arkansaw.'"

It is gratifying to note, that, with the increased facilities for travel of late years, these erroneous arbitrary pronunciations are wearing away, and that Webster's latest edition gives the pronunciation 'Ar-kân-sa.' ROB'T T. HILL.

U.S. Geol. Surv., Jan. 17.

[1] The old French methods of spelling these words are given in parentheses. They are instances of words wherein the orthography has been sacrificed, and the pronunciation approximately maintained.

The Iroquois Beach.—A Chapter in the History of Lake Ontario.

I SEND you the following abstract of a paper read by me before the Washington Philosophical Society, Jan. 7, 1888.

Of the high-level beaches about Lake Ontario, the most important is that to which the writer has given the name 'Iroquois,' after the Indian confederation who used portions of it as a trail. Fragments of this beach have long been known, but these were first correlated in New York by Mr. G. K. Gilbert, who discovered that the variations in its height were due to the differential elevation of the earth's crust. These investigations have been carried around the Canadian side of the lake by the writer, whose studies upon the origin of the Great Lakes date back for a decade. He has also followed the beach beyond the observations of Mr. Gilbert, in north-eastern New York, across the axis of maximum northern uplift, among the Laurentian ridges. In the old sea-cliffs in the region of Black River the author has found evidence of still older and greater differential elevation. At the head of the lake the height of the beach is 363 feet, south-east of the lake 441 (Gilbert), north-east, near Watertown, about 700, and at Trenton, Ont., 657 (barometric) feet, above the sea, in place of 247 feet,—the elevation of the modern lake. It is usually located within a few miles of the modern shore. At the south-eastern margin this beach sweeps around and includes Oneida Lake. North and east of Belleville, the lake, at this epoch, covered a large region, stretching to the Ottawa and down the St. Lawrence River. The maximum depth of the lake was 1,000 feet, in place of 738 feet, as at present; and of the outlet, 800, in place of a maximum of 240. The characters of the beach are described. Upon the northern side it rests upon drift-hills, but these are often replaced by more or less rocky shores upon the southern side. From Hamilton to Rochester, the eastward equivalent of the upward warping is three-fourths of a foot per mile, thence to Oneida Lake only one-fifth of a foot, and beyond a downward movement is indicated. At the eastern end of the lake the uplift increases from three feet to about five feet per mile, in proceeding northward. About the western end of the lake the northern equivalent of differential elevation ranges from 1.4 feet to three or four feet about Georgian Bay. The foci of elevation are south-east of James (Hudson) Bay. During the Iroquois epoch the lake was less than 140 feet above tide, and may have been at sea-level. In either case the outlet of the lake would have been 800 feet deep in places. There was no rock nor dirt barrier. Until further investigation shows the necessity, no other barrier will be assumed. In the Iroquois beach, remains of mammoths, elk, and beaver have been found, but no shells are known. There are lower beaches which are less perfectly developed, yet these show a decline of the warping forces. The Iroquois beach is coincident with the level of the Mohawk valley. Ontario was united with the other Great Lakes at a common level (the altitude being much lower than at the present day). This common lake (until the separation of Ontario) is here named Lake Warren, in honor of Gen. G. K. Warren, whom the writer regards as the father of lacustrine geology in America. Lake Warren is posterior to the last great ice epoch, and Ontario somewhat younger. Although the Ontario basin was somewhat warped before the Iroquois epoch, yet, so far, there is no evidence that the smaller basin formed an earlier separate lake.

In the study of the lakes the two great questions are, the origin of the valleys, and the cause of their closing into water-basins. As the valleys were shown long ago by the author to be preglacial, the second question is now being solved by the labors of Mr. Gilbert and the writer. Much unpublished information has been collected, and very much more is needed. There is now a dawn of light upon the theory and origin of the Great Lakes of North America. J. W. SPENCER.

Weather-Predictions.

IN addition to Mr. Clayton's letter on this subject in *Science* for Jan. 13, I would state that I have never objected to a fair interpretation of 'my rules' so called, which, however, were an amplification of his own. Long before the predictions closed, I wrote him, suggesting that when one predicted 'rain,' the other 'threatening,' and the weather was actually 'fair,' the prediction nearer the truth should have the more weight. It is easy to see that the intent of any rules could only be a fair comparison between predictions. As I have already stated (*Science*, Dec. 30, p. 323), in two cases Mr. Clayton came nearer the actual weather, and in eight mine were the nearer. It was only after Mr. Clayton refused this proposition and any reference to a third person that I referred the matter to an impartial judge.

I am very glad indeed to find Mr. Clayton insisting, that, when predictions are made according to a certain rule, they should be verified thereby. In the case before us I have gone over all of Mr. Clayton's predictions in the *Boston Transcript*, and find, that, if he had modified them otherwise, they would have received the same verification by Upton's scheme as by mine, or, under the most liberal interpretation, the difference would have been only two or three per cent.

I am very glad to know that Mr. Clayton verifies his predictions of three elements by only two of them, and this gives us an interesting verification of the predictions given in my first letter. If we count 'rain' = .01 of an inch or more, and apply this to Mr. Clayton's predictions, (1), we shall find that they verify 80 per cent; applying to mine, (2), 96 per cent. But Mr. Clayton's predictions were not made to be verified by this rule, so we must fall back on his official figures, which are 85 per cent.

If any thing has been brought out most clearly by this discussion, it is the absolute need of a thorough examination of the method of prediction in each case; and if a comparison is to be instituted, it should only be after a careful formulation of a method which shall give a fair test of the nearness of the prediction to the actual weather experienced, taking into account as far as possible the language used in each prediction. I know it to be a fact that a person may give the same prediction for a place in two different terms, and a seeming application of the same rules to both will give a difference of more than 35 per cent in the two verifications.

H. A. HAZEN.

Washington, D.C., Jan. 20.

Children's Development.

APROPOS of the letter of 'G.' on children's development, in *Science* of Jan. 13, I was led to make the following contribution. When my little daughter was eighteen months old, I wrote down her vocabulary, as far as was possible, a number of days being spent in the process, so that it may be assumed that it is nearly complete. The total number of words is four hundred and sixty-nine, divided as follows: —

Common nouns	227	48.5%
Proper nouns (mostly names of persons)	31	6.6%
Adjectives (including pronouns and articles)	61	13.0%
Verbs	109	23.2%
Adverbs	22	4.7%
Prepositions	9	1.9%
Interjections	8	1.7%
Conjunctions	2	0.4%
	469	100

These were all words used by the child spontaneously, and in approximately their correct signification. Only one part of a verb is counted, unless the verbal stems of the different parts are distinct; plurals are not separately counted; and words used both as nouns and verbs are counted only once. The percentages are not materially different from those in the case cited by 'G.,' but further contributions on this point seem desirable.

J. L. H.

Louisville, Ky., Jan. 18.

Sections of Fossils.

MR. FOERSTE, in No. 258 of *Science*, quotes from letters from Professor Prestwich and Dr. Geikie in regard to sections of *Bryozoa*. In referring to these authors in No. 250 of *Science*, I did so simply to call attention to what they say in regard to rock-sections in general, not *Bryozoa* in particular. It is not worth while to say more upon this point. In regard to my reference to Dr. Nicholson's work, I never inferred "that Professor Nicholson does not believe in the use of these microscopic sections," but that he stated in numerous places in both his volumes on fossil corals that in many cases it is not possible to separate species on internal structure, so recourse is had to external features; and from this fact I contend that the internal structure of these organisms is not sufficient to separate species. The old school, if it may be so called, as opposed to the new, believe that internal characters are often misleading, and that external features may more safely be followed.

JOSEPH F. JAMES.

Miami University, Oxford, O., Jan. 16.

The Influence of Forests upon Rainfall and Climate.

IN closing his valuable and interesting article in your paper of Jan. 6, entitled 'Do Forests influence Rainfall?' Mr. Henry Gannett says, "With these results in view, it seems idle to discuss further the influence of forests upon rainfall from the economic point of view, as it is evidently too slight to be of the least practical importance."

Aside from the beneficial influence of forests in the retention and saving of the water which falls, may it not be that there is an effect of the forest upon climatic extremes of heat and cold? This is well shown, I think, by the experience of western Michigan. During the early years of the settlement of the country, before the forests were destroyed, all the delicate fruits of temperate climates were successfully grown.

Since the forests are nearly gone, the tender varieties of peaches can no longer be raised, except in a few favored localities, on account of extreme winter cold; and the heat of our summers has been of late years as extreme as the cold of our winters.

H. D. POST.

Holland, Mich., Jan. 9.

Is there a Venomous Lizard?

IN connection with the inquiry in *Science* of Jan. 13, as to the existence of a poisonous lizard (*Heloderma*), my own observations would corroborate the negative answer of your correspondent. I have had in my laboratory for five years a living specimen of the Gila monster (*Heloderma suspectum*), and during a portion of this time two specimens, both in healthy vigorous condition. In November, 1883, I presented a communication to the Kansas Academy of Science, maintaining that this species is not venomous. I have repeatedly placed young kittens in the same cage with these reptiles, and have allowed them to remain together for a week at a time. During these times the kittens were frequently bitten ferociously by the lizards, but with no worse result than the temporary swelling of the part bitten from the mechanical effect of the powerful pressure. This was at first surprising to me, as intelligent miners in New Mexico had often informed me that the mere breath of this lizard was fatal to man.

F. H. SNOW.

Lawrence, Kan., Jan. 19.

Queries.

24. SILVER DOLLAR IN A POTATO. — Is there any likelihood of the truth of the following story found in a recent New York paper? On Friday last a young woman was engaged in boiling some potatoes. She tested nearly all of the Irish apples, and found that they had been cooked to the proper consistency save one. This particular 'spud' remained as hard as adamant, and, although she allowed it to boil for fifteen minutes longer than the others, it showed no signs of yielding. At last she succeeded in splitting the vegetable open, and in the centre she found a silver dollar with the date of 1886. The heart of the 'spud' was colored a blackish brown, but the outside presented a normal appearance. The silver dollar was black as ink.

Answers.

22. WASP-STINGS. — Bumble-bees and honey-bees, as well as wasps, may be safely taken in the hand while holding the breath, provided the experimenter will catch only males, which are easily recognized by their long antennæ and their face-colors. Have your correspondents been sure that they captured female wasps, which alone have stings? In the autumn the males are most plentiful, and in that season one may easily show an astonished companion how safely a wasp can be handled while holding one's breath, and afterwards while breathing also; but in doing this, I always take care to catch the right kind of wasp first. My faith in the supposed safeguard has never been sufficient to try the experiment intentionally with female *Aculeata*. Will not Mr. Safford make the test in the spring, and report his results once more? He will then doubtless agree with *Life*, that the most important thing in holding a wasp is how to let go.

W. M. D.

Cambridge, Mass., Jan. 20.

BOOK-NOTES.

— The January number of the *Quarterly Journal of Economics*, now in the press, contains important articles by Pres. F. A. Walker on the Eleventh Census; Prof. Arthur T. Hadley on the operations of the Interstate Commerce Commission; and Sidney Webb, lecturer in the City of London College, on the rate of interest. There are also minor articles by Professor Marshall of Cambridge University, England, F. B. Hawley, F. W. Taussig, and others; a letter from a Russian university on the economic literature of Russia; and a reprint of a curious pamphlet on the London goldsmith-bankers of the seventeenth century.

— The question whether the wheat of Manitoba can be transported through Hudson Bay direct to Liverpool is of serious moment to this country as well as to Canada. On this subject, in *The American Magazine* for February, J. Macdonald Oxley will throw whatever light recent exploring expeditions can afford, aided by illustrations and details of existence in a region where mercury freezes solid.

— The January *Wide Awake* is the New Year's issue, a fine holiday number, delightfully pictorial, giving as it does a dozen of the beautiful pencil-pictures of child-life by the English pencil-artist Warwick Brookes, together with an autograph letter of Mr. Gladstone's.

— The *Andover Review* enters on its ninth volume with a very strong and effective number. As usual, it combines discussion of distinctively theological subjects with studies of social and literary topics. Mr. Pettengill of Portland, Ore., under the title, 'The Mistake of Prohibition,' presents the objection to prohibition, that it violates "some of the essential conditions of efficient government under our popular system." Professor Tucker of Andover argues that the power "which is cultivating the making of drunkards as an organized industry" should be controlled, and this can only be effectually done through 'prohibition.' Professor Andrews, reviewing Sir Henry Maine's argument as to the 'Prospects of Popular Government,' presents with a clear statement of this author's position a mass of facts from political history corrective of his despondent conclusions. An editorial on 'theological pessimism' is in the same line with Professor Andrews's reasoning.

— At the Lyceum Theatre, New York, Manager Frohman is still presenting the admirable society-comedy of 'The Wife.' The *Mail and Express* of New York says, "It is the best new play produced in New York this season and the best American play ever presented." Manager Frohman regards it as the best dramatic effort of his life.

— In the article on volcanoes in *Scribner's Magazine* for February there will appear a translation, by Prof. J. G. Croswell, of the famous letters of the younger Pliny to Tacitus, describing the great eruption of Vesuvius in 63 A.D. It is believed that this is the best translation of these letters which has yet appeared.

— The critical edition of Goethe's works, issued under the auspices of the Grand Duchess of Saxony, and based on documents not available before the opening of the Goethe Archives at Weimar, has begun to appear. It is published by Hermann Böhlan, Weimar.

Calendar of Societies.

Biological Society, Washington.

Jan. 14, *Election of Officers.* — President, Mr. W. H. Dall; vice-presidents, Dr. C. Hart Merriam, Mr. Richard Rathbun, Prof. C. V. Riley, Prof. L. F. Ward; secretaries, Mr. J. B. Smith and Mr. F. A. Lucas; treasurer, Mr. F. H. Knowlton; additsonal members of council, Dr. T. H. Bean, Prof. O. T. Mason, Prof. R. E. C. Stearns, Mr. F. W. True, and Dr. George Vasey.

Philosophical Society, Washington.

Jan. 21. — Bailey Willis, Determination of Fault Hades; Robert T. Hill, The Neozoic Formations in Arkansas; Romyn Hitchcock, Notes on Eclipse Photography in Japan; G. K. Gilbert, The Flat Rock Channel.

Jan. 25. — A. S. Christie, What is a Quarternion?

Torrey Botanical Club, New York.

Jan. 10, *Election of Officers.* — President, Dr. J. S. Newberry; treasurer, J. F. Poggenburg; recording secretary, Arthur Hollick; corresponding secretary, Miss H. C. Gaskin; curator, Miss M. O. Steele; librarian, Dr. N. L. Britton; editor, Mrs. N. L. Britton; associate editors, Miss E. L. Gregory, Jas. Schrenk, C.H. Kain, Dr. H. H. Rusby, Arthur Hollick.

Byron D. Halstead, Trigger-Hairs of the Thistle-Flower (*Cnicus altissimus*); N. L. Britton, Notes on a Collection of Plants made by Mr. W. S. Rusby in the Black Hills; E. E. Sterns, Notes on *Calycanthus*.

New England Meteorological Society.

Jan. 17. — Desmond FitzGerald, Exhibition of some Thermometers made by Baudin of Paris; A. Lawrence Rotch, Exhibition of a New Cloud-Mirror, also a New Aspiration Thermometer; W. M. Davis, Hann's Meteorological Atlas.

Boston Society of Natural History.

Dec. 18. — K. Miyabe, Recent Observations in Regard to the Germination of Seeds under Water; W. Sturgis, The Absorption of Dilute Coloring Solutions by Germinating Plants; F. H. Newell, The Fossils of the Niagara Group from Northern Indiana.

Engineers' Club, St. Louis.

Jan. 4. — Charles H. Ledlie, Construction of Dam and Reservoir at Athens, Ga.; Professor Nipher, The Volt, the Ohm, the Ampere, — What are They?

Publications received at Editor's Office, Jan. 2-7.

HAWKEYE Ornithologist and Oologist, The. Vol. I. No. 1. January, 1888. *m.* Cresco, Io., Webster & Mead. 16 p. 8°. 50 cents.

HERRICK, C. L. Contribution to the Fauna of the Gulf of Mexico and the South. Granville, O., Kussmaul & Shepardson, Pr. 56 p., pl. f°.

LOCOMOTIVE Engineer. Vol. I. No. 1. January, 1888. *m.* New York, Amer. Machin. Publ. Co. 16 p. f°. $1.

MINING Industry of New Zealand, Reports on the. Wellington, N.Z., Government. 251 p. f°.

PENNSYLVANIA School. Vol. I. No. 1. January, 1888. *m.* Williamsport, Penn. School Co. 20 p. 8°. $1.

WINCHELL, S. R. The Interstate Primer Supplement. Chicago, Interstate Publ. Co. 134 p. 16°. 25 cents.

SCIENCE

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SCIENCE

FRIDAY, FEBRUARY 3, 1888.

THE COMMISSIONERS OF PUBLIC SCHOOLS of Baltimore, Md., have taken the initiative in the introduction into the public schools of that city of a series of reforms which, if adopted, will be of great benefit to the pupils. This action is the more noteworthy from having originated in the school board, the proposition coming from its committee on health, and not being forced upon it by the board of health or public opinion. It is greatly to be hoped that the mayor and common council of the city will give the necessary power and money to carry these resolutions into effect. After a preamble to the effect that sanitarians and teachers have proven that children attending school are frequently subjected to influences prejudicial to health, which often leave their effects upon the constitution for life, and that it has been demonstrated, that, by expert sanitary supervision of schoolhouses and of the pupils themselves, many of these injurious influences can be mitigated and removed, the resolutions are, that the mayor and city council be requested to authorize the commissioners of public schools to appoint an officer, who shall be a physician and expert in sanitary science, to be known as the sanitary superintendent of public schools, whose duty shall be, 1st, to carefully examine all plans submitted for the construction of new schoolhouses, and suggest such modifications as may be necessary from a sanitary point of view; 2d, to advise with the commissioners with reference to necessary alterations in school-buildings to improve their hygienic condition; 3d, to examine all text-books before adoption, in order that type, printing, or paper injurious to the eyesight of pupils may be avoided in selecting such books; 4th, to satisfy himself, by personal examination if necessary, that all pupils admitted to the schools have been properly vaccinated or are otherwise protected against small-pox; 5th, to take such other measures, in conjunction with the health commissioner of the city, as may be necessary to prevent the spread of contagious diseases in, or through the medium of, the public schools; 6th, to examine annually the eyesight of all children attending the public schools, and keep an accurate record of such examinations; 7th, to report annually, or as often as may be required by the commissioners, upon the sanitary condition of the schools, and of the pupils attending them, and to advise the commissioners upon sanitary questions connected with schools whenever required; 8th, to give instruction, by lectures or otherwise, to the teachers in the schools upon the elementary principles of school hygiene.

ASSISTANT CHARLES A. SCHOTT, assistant in charge of the computing division of the Coast and Geodetic Survey, has addressed a letter to the superintendent of that bureau which states that the discovery of records of the magnetic declination, A.D. 1714, off the coast of Mexico, by Assistant G. Davidson, and transmitted by him to this office, Dec. 7, 1887, proved to be a matter of much importance by greatly increasing our knowledge of the secular variation of the declination. By means of these observations we are able to improve materially the expressions for San Blas and Magdalena Bay, to add the new station Cape San Lucas, and to make their influence felt as far north as San Diego and Santa Barbara. It is the range which is greatly improved; besides, the epoch of maximum declination is shifted in the right direction. Apart from the fact that a region of west declination is here for the first time observationally indicated on the Pacific coast, the power of the newly recovered declinations is due to the circumstance, that, as far as known, they cover a time when the needle was in or near a phase the opposite of the present one. For want of early observations, these previously collected for San Diego and Santa Barbara, Cal., were extremely difficult to handle; and, while it was not an easy matter to establish new expressions for these stations, their correctness, or rather applicability over the whole period of time the observations cover, is quite re-assuring. He points out the desirability of new observations (either using funds yet available before July next, or providing funds to be used after that date) at San Diego, Santa Barbara, and Monterey, and states that these stations have received no attention for seven years. These observations are demanded to give greater precision to the computed variations on our charts.

ASA GRAY.

PROF. ASA GRAY died at his home in the Botanic Gardens, Cambridge, Mass., on Monday evening, Jan. 30. He had been unconscious since last Thursday, and helpless for more than a month.

Dr. Gray was born at Paris, N.Y., Nov. 18, 1810. He took the degree of M.D. at Fairfield Medical School, in 1831, but never practised medicine. After a short time spent in teaching some branches of natural history in a private school in Utica, he was induced, through correspondence with Dr. Torrey of New York, a professor of chemistry but more widely known as a botanist, to accept, in 1833, a position in his laboratory, and a little later that of curator in the Lyceum of Natural History. By Dr. Torrey's side, he began a career of ceaseless botanical activity.

His botanical publications were begun with a description of certain sedges and newly discovered plants of north-western New York. In 1835 appeared 'North-American Grasses and Sedges,' and in the following year 'The Elements of Botany.' This last was more than a mere compilation of the materials available at the time, and gave a good account of what was known of the principles of morphology, histology, vegetable physiology, and of the department in which Mr. Gray was more interested, botanical classification. Although the young writer ventured to differ from the authorities of the day, he was happy in after years in finding that these expressions of his youth needed but little change. His 'Botanical Text-Book' was published in 1842; and with this we may refer to the educational books written by him, which comprise a long list: 'How Plants Grow' (1858), 'How Plants Behave' (1875), 'The Lessons' (1857), a new edition of 'The Elements' (1887), and the 'Text-Book,' issued during the past year, which is a revised edition of 'The Lessons.' Besides these, we may mention 'The Manual of the Botany of the Northern United States' (1848), of which there were five editions, also 'Field, Forest, and Garden Botany' (1868). His 'Manual' is probably the best known, as it must have been in the hands of every American botanist since the time of its publication. The 'Genera of North America' he began in 1848, but of this but two volumes have been published, which, even in their unfinished condition, have been of great use to botanical teachers. The great work of his life is the great 'Synoptical Flora,' which had its beginning in Torrey and Gray's 'Flora' forty years ago. As far as published, it consists of a volume of nine hundred and seventy-four pages on the gamopetalous orders, but there are other portions which have been published in the Proceedings of the American Academy. It would be impossible to enumerate the numerous memoirs and papers which have come from his pen, many of which have been tributary to the 'Flora.' Dr. Gray regarded as his most important minor work 'The Relations of the Japanese Flora to those of North America,' published in 1859. This was based on the study of plants collected by Wright, and he believed this paper gave him his reputation to a large extent in Europe.

In 1834, or possibly later, Dr. Gray received an appointment as botanist of the Wilkes expedition, which was expected to start for the South Sea Islands; but delay after delay, and a change in the plans of the expedition, caused him to resign, and about this time he received an appointment to the chair of botany in the University of Michigan, then just established. He asked for a year's absence in Europe, which was granted him, during which year he not only made valuable purchases and collections for the library of the new university, but gained the personal acquaintance of the leading European botanists. He made himself also familiar with the type specimens in the older herbaria, and came back fully equipped for the work of his life, the examination of the North American flora, the first volume of his 'Flora' being completed in 1840. He never occupied the chair at Michigan, but in 1842 accepted a professorship of natural history in Harvard. The early years of his life in Cambridge were naturally occupied with routine teaching, with appliances which would be regarded as utterly inadequate at the present time; but it was a small beginning, which has led to the better-equipped Botanic Garden and to the establishment of an herbarium. He continued his work as an instructor till 1872; but during this time he found opportunities for carrying on his work on the 'North American Flora,' for the preparation of his educational treatises, and for increasing the popular interest in science. In addition to this, he devoted much time to the American Academy, in which he always took the greatest interest.

To the public not merely interested in the science of botany, especially to the religious public, Dr. Gray is well known by his writings on the relations of science and religion, and upon the Darwinian theory. Darwin, in his letters recently published, refers to Gray as one of the three or four whose judgment on his theory was of more value to him than that of the world besides, including with Gray, Hooker, Lyell, and Huxley. Darwin had been in correspondence with Dr. Gray for years before the publication of his great book, and had been gathering from him botanical facts bearing upon his hypothesis; and from the time of the appearance of that volume Dr. Gray was one of the earnest advocates of the theory as a fair working hypothesis. Many residents of Boston and vicinity will recall the earnest discussion before the American Academy, in the years 1860 and 1861, between Dr. Gray and Professor Agassiz on this great question.

Dr. Gray was crowned with diplomas and honors from all the principal universities of Europe, and during the past summer, while travelling in England, received degrees from the Universities of Oxford, Cambridge, and Edinburgh. He leaves no children, but a widow, the daughter of the late eminent lawyer Charles G. Loring of Boston; and a host of friends in Cambridge and throughout the country will feel that his death has extinguished a bright and cheering light in the world of thought, and has removed a most cherished and valued friend and companion.

HEALTH MATTERS.

Sex and Consumption.

DR. THOMAS J. MAYS of Philadelphia has contributed to the *Medical News* a very valuable paper on female dress as a determining factor in pulmonary consumption. He says that it is currently believed that more females than males fall victims to this disease. Both Laennec and Louis held this view, at least so far as France was concerned; and Ancell, one of the most prolific and exhaustive writers on the natural history of tuberculosis, concurs entirely in this opinion. Sir James Clark's statistics, which were collected from thirteen different localities in Europe and America, showed in the aggregate more deaths from phthisis among females than among males. Dr. A. James, in an interesting article on sex in connection with phthisis, lately published in *The Edinburgh Medical Journal* (March, 1886), arrives at the same conclusion. It must be admitted, too, that, if the question of sex in relation to pulmonary consumption be viewed from an *à priori* standpoint, there are sufficient reasons for believing that the female is more prone to the disease than the male, because she is generally considered to be the weaker, and because she is more exposed to the causes which are known to give rise to it. She is confined within-doors, where she naturally spends the greater portion of her life, and is, of course, subjected to the influences of impure air and bad ventilation. She leads a sedentary life, is deprived of sunlight, exercise, and undergoes the enervating processes of gestation and lactation, while, on the other hand, the male is, as a general rule, less or not at all exposed to most of such unhealthful conditions; and it is only when he is subjected to some of them, as, for instance, to impure air, sendentary occupations, etc., that he becomes notoriously liable to pulmonary consumption.

Dr. Mays has collected statistics for many of the American cities, and also for other countries, and finds, that, so far as they go, they establish the fact beyond a doubt, that in civilized life the male sex is more liable to pulmonary consumption than the female. He gives the following statistics:—

STATISTICS OF SEX IN PULMONARY CONSUMPTION.

Locality.	Male.	Female.	Remarks.
Chicago[1]	1 : 635	1 : 793	Average for 6 years, 1869, 1881-85.
New York City, 1870	1 : 233	1 : 318	
Massachusetts, 1880	2.86%	3.28%	Per 1,000 males and females respectively.
Boston, 1883-84	1 : 248	1 : 251	
Rhode Island, 1884 and 1885	1 : 380	1 : 351	
Philadelphia, 1884 and 1885	1 : 303	1 : 310	
Nashville, 1877 and 1878	1 : 263	1 : 286	Both white and colored males and females.
" " " "	1 : 443	1 : 422	White males and females only.
" " " "	1 : 142	1 : 190	Colored males and females only.
San Francisco, 1875-80	1 : 313	1 : 418	Average of 5 years.
Sacramento	1 : 340	1 : 435	Average of years 1874 and 1879.
Cincinnati, 1883	1 : 325	1 : 423	
Baltimore, 1885	1 : 342	1 : 381	
Scotland, 1871-80	1 : 423	1 : 387	
England, 1872-81	1 : 467	1 : 502	
London, 1843-46, decedents from consumption	53%	47%	See 'Ancell,' p. 396.
Basel and Zurich, 1877-84, decedents from consumption	54.7%	45.3%	See Dr. Schnyder in *Correspondenz Blatt für Schweizer Aerzte*, Nos. 10, 11, 12, 1886.
Cantons of Wallis, Waadt, Freiburg, Lucerne, from 1877 to 1884, decedents from consumption	52.5%	47.5%	*Ibid.*
Cities of Prussia, 1875-79	1 : 236	1 : 318	
County districts of Prussia, 1875-79	1 : 314	1 : 369	
Leading cities of New Jersey, 1884, deaths from consumption in nine	94	84	

Hospital and Private Practice.	Male.	Female.	Remarks.
Dr. Flint, Sr., 669 cases	505	164	See 'Flint on Phthisis,' p 50.
Dr. Williams, 1,000 cases	625	375	See 'Williams on Consumption.'
First Brompton Hospital report, 1848	61	39	
Dr. Pollock's practice	60.75%	39.25%	
254 patients of Dr. Schnyder's, coming from cities	165	89	See Dr. Schnyder, *Cor. Blatt für Schweizer Aerzte*, Nos. 10, 11, and 12, 1886.
914 patients of Dr. Schnyder's, from the country	537	377	*Ibid.*
500 of Dr. Brehmer's cases	319	181	See Brehmer, 'Die Aetiologie der chronischen Lungenschwindsucht.'
88 cases reported by Dr. Churchill of Paris	59	29	
67 cases reported by Dr. Thorowgood	34	33	
Cases in Royal Infirmary, Edinburgh, 1833, 1834, and 1835	365	217	See Reynold's 'System of Medicine,' vol. iii. p. 546.
Consumptives in three Parisian hospitals, proportioned to the whole number of inmates	1 : 35	1 : 21	See 'Ancell,' p. 397.
550 deaths in St. George's Hospital in ten years	388	162	*Ibid*, p. 763.
Chest Department of Phila. Polyclinic since Jan. 1885	113	88	
Brompton Hospital for Consumption, from 1842 to 1848	2,682	1,597	

[1] These figures indicate a lower death-rate for Chicago than actually exists, because we are not able to obtain the male and female population of this city separately: hence our estimate is based on the male and female population of Cook County, in which it is located, and for comparative purposes answers very well.

Having seen, then, that in the aggregate more civilized males than females die of pulmonary consumption; that the costal respiration of the civilized female is developed through the constricting influence of dress around the abdomen; that the lungs possess an excessive breathing surface which by sedentary occupations, etc., can be, and is frequently, reduced in a great degree; that the baneful results of such a reduction, consisting of hyperæmia, etc., fall with the greatest force on the apex of the lung; that all those who suffer from consumption also show a decided tendency to immobility of the upper part of the chest, — are we not, therefore, justified in believing that a defective costal respiration and the beginning of pulmonary consumption stand in relation to each other as cause and effect? And, going one step further, is it not clear that the civilized female owes her greater immunity from this disease in a great measure to the fact that she possesses a more highly developed costal expansion? If these relations exist, it is quite obvious that her manner of dress is a direct factor in bringing about this result. She has, by force of necessity, been led to clothe herself after a method which demands a restriction of the abdominal and diaphragmatic movements, and which cultivates a greater development of the costal portion of the breathing-organs, and thereby she unconsciously protects herself to a greater degree against this disease; while the male, on the other hand, dresses himself after a fashion which secures perfect fredom of motion to the diaphragm and to the abdominal muscles, but which also attracts and tends to confine the respiratory function to the lower portion of the chest. Moreover, it must not be forgotten that the same fashion also demands that his clothing should be suspended from the shoulders, which of itself restricts the movements of the upper portion of the chest; making it evident, therefore, that his clothing renders him, both indirectly and directly, more liable to the disease under consideration. To this conclusion, and to no other, do our facts and reasoning lead.

The evidence which has thus far been gathered from statistical, experimental, and inductive grounds, all tends to demonstrate that impairment of the respiratory movements of the upper portion of the lungs is one of the principal direct causes of pulmonary consumption. Indeed, all the proof goes to show that in many conditions of life, especially in many of those to which the male sex is exposed, the apices of the lungs become superfluous parts of the body, and on this account possess a strong tendency to that premature waste which is characteristic of all organs when they fall into a state of inactivity. The practical solution of the problem of the prevention of pulmonary consumption, as well as of the cure in many cases, therefore consists in the adoption of measures which tend to increase the chest capacity, and which maintain the general and local health of the individual.

The treatment, so far as prevention is concerned, resolves itself into a proper exercise of the chest muscles, into systematic breathing, and into the rational employment of compressed and rarefied air. First, then, as to a proper training of the chest muscles. This is accomplished by raising the shoulders, and by swinging the arms backward, forward, and upward, either with or without dumb-bells, or by exercising on parallel bars, care being taken that a full inspiration is taken every time that the arms are thrown backward and upward, or the body forward, and that a complete expiration occurs when the arms are brought together in front, or when the body is thrown backward. These movements should be performed regularly, and from sixteen to twenty times in a minute. There are a number of appliances in the market which are worked by means of ropes, weights, and pulleys, and which are admirably adapted for the enhancement of the above-described movements. They are very simple, and can be attached to the wall of the nursery or of the sleeping-room, and not only afford a healthful exercise, but a pleasant amusement for both children and adults.

BOOK-REVIEWS.

Handbook of Republican Institutions in the United States of America. By DUGALD J. BANNATYNE. New York, Scribner & Welford. 16°.

THIS would have been a remarkable book even for an experienced public official to have written, and it is doubly so, coming from a foreigner. It is the most systematic, the most complete, and the most accurate handbook of our institutions that has ever come to our notice. The author is a Scotch attorney, resident for twenty-two years past in Canada and the United States. In his preface he gives the reason for writing the book. "I have frequently heard it said," he writes, "that an immigrant into either of these countries, who brings some capital with him, is not likely to permanently succeed until he has lost all he brought with him and has started afresh." The author's personal experience corroborates this saying, and he attributes its truth to the fact that immigrants are ignorant of the country, the people, the customs, the government, to which they have come. To aid such in removing their ignorance, the book before us was written. But its existence can be and should be defended on far broader grounds. It is a mine of information for the American citizen himself, or at least it would be if it had an index. No table of contents, however full, can take the place of a good index.

The work consists of an introductory chapter and two parts. In the introduction the author gives a cursory view of our political life, its conditions, and its most recent workings. Rather too many statements rely upon the somewhat vivid and always vehement imaginations of the New York *World* for their foundation; but this is a minor matter, and may be overlooked. Mr. Ballantyne betrays his foreign extraction by criticising the equal representation of States in the United States Senate. The populations and areas which he cites as evidences of inequality of representation have absolutely no bearing upon the question whatever; for it is States as such, and not populations or areas, that are represented in the Senate. In these days, when so much ignorant criticism and unintelligent abuse are directed at public officials, it is pleasant to find that a disinterested and presumably non-partisan foreigner can write as follows: "The reader's attention should be attracted by the manner in which the whole population is, through Congress, kept thoroughly posted as to the several executive departments, and the whole United States and state, county, town, village, and city machinery. . . . The writer has on several occasions tested the merits of the federal, state, county, and other public officers, and has always had prompt response and courteous treatment. There is no unnecessary red-tapism or flummery, and every respectful application, whatever the form, receives attention" (p. 51).

Part first contains the great national documents, — the Constitution, Articles of Confederation, Declaration of Independence, and Washington's Farewell Address (which in some places the types make 'Farewell Letter'). Then follow careful, painstaking, and accurate descriptions of Congress, the Presidency, the Executive Departments, and their numerous bureaus and divisions. Every branch of the national administration is touched upon. The Territories are described, and the Enabling Act of Colorado given, to show by what process a Territory becomes a State.

Part second treats of State government and administration. That of New York is taken as a type. This is just as full and comprehensive as the preceding part, except in the case of cities. They are very scantily treated in two pages, whereas at least twenty-five would be necessary to make clear their organization and relation to the county and State governments. The subject of education and school organization is amply treated. We lay down the book with a feeling of profound satisfaction, and with full appreciation of its value as a book of reference.

The author's descriptions are impartial, and he rarely presents his own opinions or views. When he varies from this rule, his success is such that we are tempted to wish he did it oftener. Witness this comment: "There is need for a national bureau of immigration and naturalization, in which shall be kept a register recording the names and full particulars of every immigrant, and also a register of every immigrant naturalized under the laws of the United States, and which shall refer to the entries in the other register."

We commend the book unreservedly.

Organic Analysis. By ALBERT B. PRESCOTT. New York, Van-Nostrand. 8°.

THIS volume is in a measure an outgrowth of the useful little book put forth by the same author thirteen years ago under the title of

'Outlines of Proximate Organic Analysis,' and deals mainly with certain common organic compounds of importance in commerce or pharmacy. Many topics which are touched upon in the smaller book — such, for example, as the properties of the alcohols and alcoholic derivatives, and of the carbohydrates — are here passed by, excepting, perhaps, mere incidental mention; but such substances as are discussed at all, are in general treated fully and exactly, with liberal citation and reference to authorities. The alkaloids naturally hold an important place; and schemes for plant-analysis, the examination of coloring-materials, and the separation and identification of fats and oils, are prominent. The title of the book is suggestive of a view broader than that actually presented, but it should be said in this connection that information upon the more important topics omitted is easily accessible elsewhere. This book is a decidedly valuable contribution to the literature of analysis.

Elementary Chemistry. By M. M. PATTISON MUIR and CHARLES SLATER. Cambridge, Eng., University Pr. 12°. $1.25.

Practical Chemistry. By M. M. PATTISON MUIR and DOUGLAS CARNEGIE. Cambridge, Eng., University Pr. 12°. 80 cents.

THESE two books are complementary, and together outline a progressive course in elementary chemistry.

The 'Practical Chemistry' leads experimentally from the demonstration of the distinction between simple physical and chemical changes up to such topics as the investigation of atomic weights, the phenomena of dissociation, the relative affinities of acids, the constitution of compounds, rates of etherification, and specific volumes; the acquisition of the elements of qualitative and quantitative analysis being assumed as an intermediate and outside incident of the course of work. The 'Elementary Chemistry' presents the essential facts and theories of chemistry, carefully distinguished and correlated in a clear and logical manner, the properties of bodies being discussed in the light of the 'periodic law.' The plan of instruction is in many respects unique and admirable, and reflects very strongly the growing tendency toward the early introduction of methods approximately quantitative.

Down the Islands. By WILLIAM AGNEW PATON. New York, Scribner. 8°. $4.

THE author, who made a brief voyage to the Caribbees and British Guiana, tells the experiences and observations of his voyage. In an introductory note he confesses that on starting he had no knowledge whatever of the country he was going to visit. If this be true, he has made good use of his brief trip, for the book contains much valuable information; not the less valuable, as told in a very attractive form. In reading the description, it would seem as though the writer gives nothing but the impressions of an observant traveller who is unexpectedly taken to a world entirely new to him; and this makes his tale very charming. His remarks show that he is quick to catch the characteristic features of the country he visits; and his descriptions of the character of the several islands, of the English and French Creole, of the negroes, the 'black and yellow Caribs,' and of the Hindu coolie, are worth reading. Besides, a considerable amount of reliable statistical and historical information is embodied in this book, which gave us greater pleasure and satisfaction than many a pretentious book of travel.

Under the Southern Cross. By M. M. BALLOU. Boston, Ticknor. 12°. $1.50.

THE author, who has spent much of his time in travelling all over the world, tells in the present volume the story of a journey to the Pacific Ocean. Starting from Boston, he crossed the continent, and began his sea-voyage in San Francisco. A few days were spent on the Hawaiian Islands, a few hours' stay was made at Samoa, and then he proceeded to New Zealand and Australia. The time has passed when scientific results of great import may be gleaned from such a journey; but the author tells in an attractive form his observations and experiences, and gives us a glance of the life of the colonists and natives of the Pacific Ocean so far as he has seen it.

Special attention is devoted to the political relations of the South Sea colonies to America and Europe. The author dwells upon the question of the proposed federation of the Australian colonies and the probability of their becoming an independent republic, upon American influence in Hawaii and the development of American trade on the islands in consequence of the reciprocity treaty, and upon the late events in the Samoan Islands. Australian stock-raising and mining, and British immigration to these countries, are discussed, as well as the influence of the Chinese and of coolie labor, but the main and best part of the book are the interesting sketches of cities. Several descriptions of scenery are vivid and attractive, but those passages in which the author attempts to touch upon questions of geography or ethnology show that he has only paid a flying visit to the Pacific Ocean, and that he has not lived long enough in those regions to gain a thorough insight of their nature and of their natives.

NOTES AND NEWS.

THE *Railway Review* says that the Russians are pushing forward the Transcaspian Railroad as rapidly as possible. Seven thousand men are now grading the road through Bokhara. It is now ready for the rails for four-fifths of the way between the Oxus and Samarcand, nearly three hundred miles; but the track cannot be laid until the bridge over the Oxus is completed. This bridge, now more than half finished, will be three miles long. It will connect the road now completed to the Oxus with the extension to Samarcand, and next spring the line will probably be in operation.

— It is but a short time since we called attention to Edwards's 'Butterflies of North America,' and now a new part lies before us. Indeed, within a twelvemonth four parts of the new series have appeared, the intervals between them being briefer than has been the case with any preceding numbers in the twenty years it has been running. More species of the prolific genera *Colias* and *Argynnis* are figured, but the specially attractive plate of the number — and there is always one — is that devoted to *Cœnonympha california*, or *galactinus* as Mr. Edwards would prefer to have us call it. The transformations of this genus are now for the first time illustrated by the early stages of one of our American forms; and the number of exquisite figures given to these early stages would be deemed almost luxurious if we were not accustomed to this kind of generosity on Mr. Edwards's part. The species is abundant on the Pacific coast, but was first raised in West Virginia from eggs sent the author from California, and we now know its history better than any species of the genus is known in Europe. Two forms, distinguishable by slight differences in the intensity of the markings, have long been regarded as one and the same species; but it was reserved to Mr. Edwards to prove by his precise experiments that the two were seasonally dimorphic forms of one and the same species, the darker giving birth the same summer to the lighter. We wish that this work, so great a credit to American science and American art, were better supported, and not published at so heavy an expense to its indefatigable author. It is in fact superior, both in matter and in execution, to any thing which is done abroad, and ought to receive ample support at home. Yet we chance to know that nearly forty per cent of the regular subscribers to the work come from outside of the United States. This shows, indeed, its appreciation in other countries; but it is a kind of work which should be found in every considerable library of the country, as a stimulus and an aid to workers young and old, and to show what one man, remote from associates, libraries, and even from much of his own field of work, may accomplish therein.

— Gardiner G. Hubbard, C. E. Dutton, O. H. Tittman, J. H. Gore, C. H. Merriam, J. R. Bartlett, R. Birnie, jun., J. W. Powell, Henry Gannett, A. H. Thompson, A. W. Greely, Henry Mitchell, George Kennan, Marcus Baker, and Gilbert Thompson, all of Washington, have incorporated the National Geographical Society for a term of one hundred years. Its principal objects are to increase and diffuse geographical knowledge, to publish the transactions of the society, to publish a periodical magazine and other works relating to the science of geography, to dispose of such publications by sale or otherwise, and to acquire a library under the restrictions and regulations to be established by its by-laws. The officers elected for the current year are as follows: president, Gardiner G. Hubbard; vice-presidents, H. G. Ogden (United States Coast and Geodetic Survey), Com. J. R. Bartlett (Hydrographic

Office), Gen. A. W. Greely (chief signal-officer), Dr. C. Hart Merriam (Department of Agriculture), A. H. Thompson (United States Geological Survey); treasurer, C. J. Bell; secretaries, Henry Gannett (United States Geological Survey), George Kennan; managers, Dr. J. C. Welling (president of the Columbian University), W. B. Powell (superintendent of schools, Washington), Capt. Rogers Birnie, jun., U. S. A., W. D. Johnson (United States Geological Survey), Henry Mitchell (United States Coast and Geodetic Survey), Marcus Baker (United States Geological Survey), G. Brown Goode (National Museum), Cleveland Abbe (United States Signal Office).

— 'Little Poems for Little Children' and 'Stories for Little Readers' (Chicago, Interstate Publishing Company) are books of elementary reading for students in primary grades. They are considerably above the average of such books.

LETTERS TO THE EDITOR.

*** *Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

Twenty copies of the number containing his communication will be furnished free to any correspondent on request.

The editor will be glad to publish any queries consonant with the character of the journal.

A New Meteorite from Texas.

WE have this day received a new entire meteorite from Texas, weighing about two hundred and eighty pounds. It belongs to the class siderolites, although the nickeliferous iron apparent to the naked eye is scarcely more than in some of the aerolites. Olivine is present in great abundance, giving a yellowish-green appearance to the whole mass. A hasty examination also reveals anorthite and a few specks of a bronzy looking metal, which is doubtless noilite. The meteorite was brought to us by one of our assistants, who found it near the south-west bank of the Colorado River, about three miles south-west of La Grange, Fayette County, Tex.: we would therefore suggest the name of 'The La Grange Meteorite' for it. A fuller description, with complete analyses, will be published later.

WARD & HOWELL.

Rochester, N.Y., Jan. 31.

Jacobson's 'Higher Ground.'

YOUR notice of 'Higher Ground' in *Science* (x. No. 254) was so kindly, that I hesitate to impose upon your good nature by asking you to devote additional space to the subject. And whatever I may say will not be said in a spirit of controversy.

You approve of manual training in public schools, and you approve of the succession-tax as a means of enabling all children to get the benefit of the schools. Your only question is, Would the proposed succession-tax pay the bill? and your answer is, that it would not.

If a change so great as the one proposed could be made all at once, the proceeds of the succession-tax would not be sufficient to pay the bill. But it would take years and years to bring about so vast a change; and I believe that the proceeds of the succession-tax would be sufficient to pay the bill as fast as the change could be brought about, because wealth is increasing much faster than population. As an illustration of a change to which there is comparatively little opposition, see the length of time it takes for the high-license movement to make its way, — a movement full of good sense, to which, from pecuniary interest only, the liquor-dealers are opposed. What would not the opposition be to the succession-tax movement, and the apparent absurdity of paying people for keeping their children at school?

To say that there were in this country, in 1880, 8,347,731 children of the age in question; and that to pay, at the rates proposed, three-fourths of their number for going to school, would require $919,502,737.50; and that this sum could not be raised by the proposed tax, — is not that very much as if some one had said in 1830, "To do the transportation business of this country, we shall need 140,000 miles of railroad, costing eight thousand millions of dollars, and such a sum could not be raised for such a purpose"?

The money for the railroads has been found, because it has been found that railroads develop and enrich the country; that the money spent for railroads comes back, and comes back a hundred-fold.

The money for the education which I propose will be found when the people shall become convinced, that, invested in improving the brains of the people, — the motive power of all motive powers, — it will be more profitable than money invested in railroads or in any other enterprise whatever; that the money spent will come back, and come back a hundred-fold.

If in 1830 any one had predicted that in 1888 we should have our present mileage of railroads at its present cost to the country, he would have been laughed to scorn, because such an expenditure for highways must then have appeared absurd to the average man. But we spend all this money for highways, and thrive by it.

The figures in 'Higher Ground' are only tentative, re-adjustable at every point. Any public body into whose hands the practical working should fall would of course cut its garment according to the cloth on hand. My proposition is, that children shall be paid for going to school from twelve to twenty years of age, and that the amount to be paid for the eight years shall be $1,200. But if only money enough could be raised to keep them at school till eighteen, then the pay must cease at eighteen. That would require, in all, only $575 for each child. If at first only enough could be raised to keep the children at school till sixteen, then sixteen must be the limit. That would require, for the four years of each child, only $250. Even then the gain of the people in intelligence and efficiency would be immense, and the expense for the four years would be $250 only, instead of $1,200 for the eight years.

My proposition is, that all children from twelve to twenty years of age shall be paid for going to school substantially what they could earn out of school: at the age of twelve to thirteen, $50; thirteen to fourteen, $75; fourteen to fifteen, $100; fifteen to sixteen, $125; sixteen to seventeen, $150; seventeen to eighteen, $175; eighteen to nineteen, $225; nineteen to twenty, $300.

This, I think, would keep the children at school, and we should have an intelligent and efficient population, such as the world has never yet seen. Perhaps a trifle less annually would keep the children at school. I should be in favor of the smallest amount possible that would accomplish the object. But of course this could not begin all at once all over the country. If the proposition shall ever be carried out anywhere, it would take years and years after the beginning before all parts of the country would adopt it. All the children would not go. Wealthy people would still prefer to send their children to private schools; perhaps some Catholics, not many, would persuade themselves that the supposed interests of their children in the next world demand their absence from the American public school; and there are perhaps people among us so shiftless or degraded that they would not send their children to school, no matter what the inducement.

It is not necessary that I should be able to show that we could to-day provide for a state of things which can only be brought about after years of agitation. The state of things which I advocate can only come about gradually. The people will have to be convinced. Schoolhouses will have to be multiplied, and these things can only be done slowly and gradually. That the tax would be sufficient to begin with in large cities, there can be no doubt; and, as wealth increases more rapidly than population, the proceeds of the tax would tend constantly to come nearer being sufficient than it would be to begin with. In discussing matters of taxation, the *Chicago Tribune* said a few days ago that there are five hundred millionnaires in New York City: there were probably not fifty millionnaires in New York twenty years ago. There are probably one hundred millionnaires in Chicago to-day: twenty years ago there were not five. Smaller fortunes are increasing in proportion. Wealth is increasing much more rapidly than population.

No man can tell what the succession-tax would yield: it can only be found out by experiment. Did we not lower the tariff in 1883 to decrease the surplus, and then find that we had a steadily increasing surplus? I do not pretend to be able to calculate what the succession-tax would yield in the whole country, nor in any one state or city. On p. 44 of 'Higher Ground' I gave it as an estimate that the tax would yield annually from three to six millions in Chicago, and from twenty to fifty millions in New York. To this estimate I still adhere. The many large estates falling in from time to time show it to be a moderate one. The tax would enable us to begin, and every year it would prove more nearly adequate: every few years we should be enabled to take in children of a more advanced age. The *New York Times* of Jan. 13 gives a summary of the comptroller's report of the State finances for 1887. The collateral inheritance law yielded for the year $561,716.23. The comptroller says it might easily in some years produce a million, and yet under that law no lineal inheritance is taxable. The greater part of the money came from eight estates: estate of Henrietta A. Lenox, New York, $76,534.27; estate of Mary J. Morgan, New York, $64,201.64; estate of Cornelia M. Stewart, New York, $61,232.03; estate of Calvin Burr, New York, $39,711.46; estate of Hannah Enston, Kings County, $40,068.20; estate of Sarah Marrow, New York, $14,077.35; estate of Mary E. Miller, Orange County, $15,796.65; estate of B. F. Bancroft, Washington, $10,419.60. This tax, being on collateral inheritances only, reaches only a small number of successions.

I speak of the apparent absurdity of subsidizing parents to keep their children at school. Several of my friends are at the present time supporting boys in manual-training schools. These friends of mine are not doing any thing absurd, are they? No, they are doing an excellent thing for the boys. Many colleges give aid and assistance to students. To do what I propose would be only doing what the colleges have always done, and are now doing, to the best of their ability, — helping indigent students to get an education. There is nothing absurd about that, is there? Why should it be absurd to do for all what it is wise to do for the few? Besides, the education itself would immensely accelerate the acquisition of wealth, just as the small beginnings of railroad-building from the thirties to sixties helped to accelerate the increase of wealth sufficiently to give us the railroad mileage of 1888. What the world has acquired in the way of knowledge would be known to all, instead of being known only to the few: all, instead of only the few, would have access to, and would utilize, the world's stock of knowledge, and the difference this would make in the production of wealth cannot be estimated. Where there is now one millionnaire, there would be a thousand of them under the new state of things, and all the people would be in comfortable circumstances. That increase of knowledge brings increase of wealth must be clear to every one. If, instead of our present population, we had a land full of Russian Moujiks, or of people born in Spain or in Arkansas, we should not be troubled with a surplus.

The education which I propose means that no child shall go through life in the raw state; that every child shall be a finished product; and that society shall get upon every human being born the profit of the finished product, instead of such profit as there is in letting humanity go through life in the raw state, as it were.

The world is wasting its knowledge by confining it to so few. It is as if a man were to leave his family a million, and provide that only a hundredth part of it should be put out at interest to produce income. We should call such a man foolish. Well, in like manner the world is stupid in confining knowledge to the few, and depriving itself of reaping the benefit of the service of the many in their best estate. Say that a man has five children and $100,000. He can educate his children well, and leave them $80,000; or he can let them go to school till they are twelve years old, and then leave them $100,000. Can any sane person doubt which would be the better course for the children? Can any one doubt which course would be the more likely to preserve the estate? Can any one doubt which would be the more likely to increase it?

But the children whose education I advocate have not the money to enable them to be educated, and their parents have not the money wherewith to educate them. Must the rich educate the poor? I say yes; if the rich wish to live in comfort in a country governed by universal suffrage, they must do their share, and more than their share, to educate everybody. As I believe, the people who would pay the money would get a handsome return upon their investment, even those who should pay at the highest rate.

Years ago I said, and I quote it here from Prof. C. M. Woodward's recent book, 'The Manual Training School,' published by Heath & Co., —

"The alternative before you is more and better education at greater expense; or a still greater amount of money wasted on soldiers and policemen, destruction of property, and stoppage of social machinery. The money which the training would cost will be spent in any event. It would have been money in the pocket of Pittsburg if she could have caught her rioters of July, 1877, at an early period of their career, and trained them at any expense just a little beyond the point at which men are likely to burn things promiscuously. It is wiser and better and cheaper to spend our money in training good citizens than in shooting bad ones."

The first requisite is to convince the people that the thing itself is worth doing. That done, the means to accomplish it will be found. The thing proposed "is not a largess to the recipient, but a natural measure of self-defence on the part of the government which educates."

I propose it as a measure for the welfare of the community, and the welfare of the community is the supreme law.

Once established that it is the height of wisdom at all hazards and at any cost to bring the children into school and keep them there till the twentieth year, if necessary other means besides the succession-tax would be found to pay the expense. The $500 license-tax on saloons yields annually in Chicago nearly two millions. It is a new revenue never before counted upon for municipal purposes. Before we had it we got along very well without it, and we could again do so. To what better use could the license money be put than to keep the children at school? And the tax might be doubled. Double our rate, and liquor-licenses would annually yield in New York City something like ten millions. Then there is the internal revenue derived from tobacco and whiskey, yielding annually over a hundred millions, which is every day in danger of being abolished because we have no use for the revenue. This tax, unless seized upon for education, is liable at any moment to be repealed. Its appeal would be a calamity. The tax bears heavily only upon vice and crime. No useful industry is hampered by it. There is not one single good reason why it should be repealed. To what better use could the proceeds of this tax be put than to be paid out for keeping the children at school? The whiskey and tobacco tax might be doubled, and nobody be the worse for it. It is low now in order that it may not produce too much revenue. If the revenue were needed for a good purpose, the tax might well be doubled and yield over two hundred millions.

In the sense in which I speak of the settling of the labor-troubles, they would be settled if we could get along without periodically employing soldiers to use force. The graduates of the manual-training school would be just that many people taken out of the labor-problem; and, if the number so taken out was sufficient, there would be no labor-problem left.

Each individual trained to a degree to find an independent way for himself instead of relying merely upon the work of his hands to be directed by the brains of some one else, is to the extent of that individual a settling of the labor-troubles. The settling would operate as things did in Germany in the time of the first Napoleon. So long as German soldiers fired their guns at his command upon his enemies, he maintained his supremacy in Germany; but when the Germans took to shooting at him and his, instead of for him and against his enemies, there was end of Napoleon's supremacy. Sufficient training, intelligence, and efficiency would make all our people for peace, and there would therefore be peace. The lawlessly disposed would be so few and lonesome that they would cease to riot. If I may be allowed an Irish bull, the lawless could be made to shoot the other way by being made so intelligent and efficient that they would refrain altogether from shooting.

AUGUSTUS JABOBSON.

Chicago, Jan, 24.

Weather-Predictions.

IF Professor Hazen is willing to admit, as I infer from his letter in *Science* of Jan. 27, p. 49, that the Blue Hill predictions for last October give a higher per cent of success than his own when verified by the unmodified original rules he sent me, it seems to me there is an end of the matter between us. I do not deny that better methods of verification of weather-predictions are wanted. All that I have ever claimed is, that the Blue Hill predictions, when verified by the Signal Service rules, in accordance with which they were made, give a higher percentage of success than the Signal Service predictions for this vicinity. Professor Hazen made the predictions for the Signal Service during October; and if more extended comparisons between his predictions and those of Blue Hill are of importance, why not compare the Blue Hill predictions with the similar predictions of the Signal Service, published in the same newspapers? The Blue Hill predictions were made for south-eastern New England, and I am perfectly willing that they should be verified for the States of New Hampshire, Massachusetts, and Rhode Island in accordance with the published rules of the Signal Office (see chief signal-officer's report for 1886). In making the Blue Hill weather (not temperature) predictions, the phraseology and definitions of the Signal Service have been closely followed; and, if any of the readers of *Science* care to extend the comparison, I will gladly furnish them with the past or future Blue Hill predictions as they appear in the Boston papers, since I am confident that these, when verified in accordance with the published Signal Service rules, will give a higher percentage of success than the predictions of the Signal Service. When it is considered that the Blue Hill predictions are extended for nine hours longer in advance than those of the Signal Service made from the same telegraphic reports, and that less than one-third the telegraphic data at the command of the Signal Service are available at Blue Hill, it seems clear that by improved methods and more localized predictions the efficiency of the Signal Service could be greatly improved and its expenses reduced. During January the Blue Hill predictions will average something like fifteen to twenty per cent higher than the Signal Service predictions for this locality; and this seems of interest, since I understand that Professor Hazen, who is assumed to be one of the leading predicting-officers, made the Signal Service predictions for this month. H. Helm Clayton.

Blue Hill Observatory, Jan. 30.

Hybrid Diseases.

In a paper presented at the recent meeting of the American Public Health Association (*Science*, x. 289), Dr. E. M. Hunt of the New Jersey Board of Health brings out some original ideas about disease-germs, that are likely to prove misleading to persons whose knowledge of the subject is derived from the public press. The etiology of so many zymotic diseases is now under investigation by experts in bacteriology, that the general reader or practitioner who is not an investigator is severely taxed to keep track of the often conflicting and incomplete results; and an especial effort should be made to avoid unnecessary complication of the subject by the introduction of theories not based on a correct understanding of what is known or extremely probable.

Excluding the protozoan claimed by Laveran and others as the cause of malarial fever, the moulds that occur in connection with certain local diseases of the ear, etc., and the *Actinomyces* of man and some other mammals, the active agents of common parasitic diseases that are at all credited are bacteria. One of the systems of classification now generally used recognizes four main divisions of lower plants below mosses and liverworts, — thallophytes, zygophytes, oophytes, and carpophytes, — beginning with the lowest. Bacteria fall by common consent into the first and lowest of these groups, — the protophytes. This group is a sort of *omnium gatherum* for many things that cannot be placed elsewhere, and is chiefly known by negative characters, the absence of much evident structural differentiation, and of any form of sexual reproduction, heading the list. This being the case, it would partake of dogmatism to make any very emphatic assertions about the plants that now find lodgement in it; yet it may fairly be said that no theory that rests upon the assumption of sexual processes in any of the protophytes is tenable. Hybridity is usually the result of sexual union between representatives of two more or less nearly related species, and in this sense is not only not known among plants of this group, but very improbable, since they have thus far given the best investigators no indication of even the simplest form of sexual union, — conjugation. The only other mode of hybridizing, if it really be such, corresponding to the formation of 'graft-hybrids' among flowering plants, could come only from the fusion of individuals of two species, and would amount to conjugation. It seems to me, therefore, that such a theory of hybrid diseases as Dr. Hunt has propounded is entirely untenable, and a very unfortunate addition to a literature already overcrowded with notions that others must eliminate.

I fear that my friend Mr. Meehan wrote his opinion on lichens rather hastily, and perhaps without intending to have it given to the readers of *Science*, or he would scarcely have expressed the belief "that all lichens are hybrids between fungi and algæ." Botanists do not agree on the lichen question, any more than physicians do on the germ-theory of disease; but neither the followers of Schwendener, nor the old school, would be likely to advocate the hybridity that Mr. Meehan believes to be conceded. The relationship of the two parts of a lichen, according to the Schwendener school, is merely that of association, either parasitic or symbiotic, and in no sense comparable to hybridization, while the advocates of lichen autonomy hold them for parts of one and the same individual.

Realizing fully the advisability of excluding dogmatism from the discussion of all that pertains to sanitation, I have written this correction in no *ex cathedra* spirit, and I trust that it will not appear to either Dr. Hunt or Mr. Meehan as any thing more than an effort to check the entrance of error into the discussion of one of the most important subjects that is prominently before the public. William Trelease.

St. Louis, Mo., Jan. 28.

Color-Blindness.

Referring to your comment in *Science* of Jan. 27, I would say that I have always believed that the defect of color-blindness could be accurately described only by one who, like myself, is subject to the peculiarity. From an early age I have been aware of the trouble, and by my attempts to assign names to colors have often furnished my friends much amusement. I have made many efforts to correct the defect, and am convinced that any attempts to educate the color-sense will result in no benefit to those who are really color-blind.

There are two sets of colors which in my mind will always be hopelessly confused. The greens, browns, and reds comprise the first; and the blues, pinks, and purples, the second. None of these colors seem to me absolutely alike. The contrast, however, is not striking, and I should describe each of the three as different shades of the same color.

Being near-sighted, I could not at a distance distinguish the blossoms from the leaves of a bed of scarlet geraniums. On approaching, however, I could readily detect the difference, but should describe the flowers as darker than the leaves, though to my eyes somewhat similar in color. While riding through the fields of France, members of our party frequently exclaimed at the multitude of scarlet poppies in the grass. Though I looked with longing eyes, not a poppy did I see during the entire journey. Similarly I am unable to detect cherries upon the trees, or strawberries on their vines, unless quite near to them. Notwithstanding this confusion of green, red, and also of brown, I can, by the worsted test, detect a difference in all the shades of these three colors. If I attempted to assign names to the various hues, it would of course be mere guess-work. The neutral tints of a November landscape, too, possess great beauty for me. The green of the grass, the browns of the leafless trees or of the soils in adjoining fields, the sombre hues of the sky, are all pleasing to my eye. Such being the case, the term 'color-blindness' seems altogether a misnomer.

The second set of colors I should describe as follows: pinks, blues, and purples are closely allied; I should call them all blue. Pink seems a lighter, and purple a darker, shade of the same hue. But, as in the case of the first set, all variations of these three colors are readily manifest to my eye.

It may seem too strange to be true, but I have frequently arranged flowers into bouquets which have been perfectly satisfactory to those who are not color-blind. I have, of course, no means of determining whether a brilliant sunset is more charming to others than to myself. I fancy that my defect deprives me of very little of its beauty.

Although in the rainbow I can distinguish only the red, yellow, and blue, it is probably as attractive to me as to others. I have as yet failed to find any one who can readily detect the seven primary colors. It is said of Dalton, from whom color-blindness was once named, that he could distinguish only the colors of blue and yellow in the solar spectrum. Dr. Mitchell tells of an officer who chose a blue coat and a red waistcoat, believing them to be of the same color; of a tailor who mended a black garment with a crimson patch, and put a red collar on a blue coat. Such mistakes seem quite as ridiculous to me as to others. Yellow and black I have never confounded with other colors.

There is such a diversity in color-blindness, that it seems impossible to determine the cause. I am convinced that it is a physical defect. The eye, as a mechanical instrument, has not been found at fault. The cause is undoubtedly due to some peculiarity of cerebral formation. Like the cause of left-handedness, which is due to unusual development of the right brain, color-blindness is due to a freak of nature.

The education of the color-sense among the children of the primary schools has proved of great value in removing that uncertainty in distinguishing colors which of course may be found among most ignorant people, old or young. This has its parallel in the education of the ear to the appreciation of all the variations of the musical scale. But for one who is really color-blind, education can be of little avail in correcting the defect. W. B. HARLOW.

Syracuse, N.Y., Jan. 27.

A New Text-Book on Zoology.

THERE can be no better evidence of the growing interest on the part of certain reading-classes of all ages, and the importance that is being daily attached to biological studies by school authorities and educators, than the ever-increasing demand for good text-books in zoölogy, and the frequency with which such volumes put in an appearance. We now have before us a thoroughly revised edition of Steele's 'Fourteen Weeks in Zoölogy' (New York, Barnes), — a little work that held its place with great popularity for ten years, and which has now been almost entirely rewritten by Prof. J. W. P. Jenks of Brown University, who is quite responsible for its present form.

From the author of the work I learn that the volume in scope is principally designed for beginners in our high schools and academies at the average age of fifteen to eighteen years, in which schools they have no special means for illustration. Moreover, to be efficient as a text-book, it is intended to be used only by a class of teachers who presumably possess quite a thorough knowledge of general zoölogy, drawing, dissecting, zoölogical aids and appliances, and kindred subjects. Taken as a whole, were this volume placed in the hands of such a teacher, and its chief aim to be to impart a notion of general zoölogy to a class of students of the average age mentioned, after faithfully following out its chapters for three or four months, we must believe that no better work has yet appeared having a higher claim to such an end. Its pages are crowded with beautiful cuts of the forms used in illustration of its text, which cuts and illustrations have been for the most part admirably chosen; and, notwithstanding its unavoidable brevity, the subject-matter, as a rule, is presented in a manner calculated to interest and instruct the student at every step. It seems to me, however, that even in a work of this character its author should add a page to his preface, and explicitly state in words and figures and acknowledge to whom he is indebted for his illustrations. We find here numerous drawings of birds taken from Audubon and Wilson, and many others, without a word of such acknowledgment, and the oversight occurs throughout the work. We must believe that even young academical students should be taught that this is not the proper custom; but where an author meets with such material assistance, it should be duly noted. An excellent feature of the work consists in properly dividing and accenting the technical names to assist in their pronunciation; while, on the other hand, a serious defect is evidenced in the absence of a 'glossary of terms' at the end of the volume.

In the main, the classification adopted shows the impress of recent views in the premises; but here, as much as anywhere else, it needs the explanation of a skilled teacher, as the student would gain but a very erroneous idea of the subject from this work alone, as no family nor generic lines are drawn. Take, for example, the order *Passeres*, where lyre-birds, birds-of-paradise, finches, crows, and larks, follow each other in the order I have given them, without a single word of explanation as to their affinities. Then again we find the author at total variance with the leading authorities in placing the bats in the order *Insectivora*, without a word as to why such a step should be taken. Nor will he meet with full support in his order *Bimana*, containing only "one genus and a single species," and that species having "the rank of a being who is alone declared to have been created in the image of God" (p. 277). We have no scientific proof for this latter view. Beneath about half the figures we find given in parentheses each one's proportionate size as compared with the living subject: we regret that this excellent idea was not carried out through the entire work, and it will be well for future text-books in zoölogy to adopt this plan. Written, as the author of this work declares it is, for a class of students as late as eighteen years of age, to my mind it exhibits another thoroughly fatal omission, for it has not a word to say of that great universal law pervading all nature and the world, which explains the very origin of organic forms and the relations of the living ones to those now extinct. Should a young man of eighteen years of age complete the course pointed out by this work, and yet be ignorant of the law of evolution, I hold his zoölogical studies have been but poorly grounded. A companion work to the one under consideration on physics would be in the same case, had it omitted the law of gravitation.

The object of a text-book in zoölogy for a class of students from fifteen to eighteen years of age should not have as its aim the endeavor to teach the greatest number of names of animate objects, for at the present day that is a hopeless task, even were it a desirable end. It should, on the other hand, undertake to make clear the general principles of biological classification; it should by a careful, detailed study of a few types, both vertebrate and invertebrate, clearly point out the universality of morphological laws, then these two lessons should be combined; next, it should be clearly shown the relation between living and extinct types, and finally, by a few clear examples, show the origin of certain forms, as the birds from reptiles, and the ancestry of the horse, and so on; all of which is far more comprehensible than a jumble of isolated facts unconnected by any known law. Such a course, properly expanded and illustrated by a competent teacher, will give a student at once a more intelligent appreciation of life and living forms; make him a better observer; create in his mind a more healthy interest in the subject; and finally send him forth with a kind of stimulation and systematized knowledge which fits him to further pursue biological research, should it happen in any given case to be imparted to the mind of a student cast in the biological mould.

R. W. SHUFELDT.

Fort Wingate, N. Mex , Jan. 9.

The Flight of Birds.

IT is with great diffidence that I take part in a discussion participated in by such eminent authorities as Professor Newberry and Professor Trowbridge, and it is with still more hesitation that I venture to disagree with any opinions brought forward by either of these gentlemen. Nevertheless, I can but feel that undue stress has been laid upon certain facts, while others of equal importance have been overlooked or incorrectly stated.

To a great extent the discussion hinges on the assumption that birds need some mechanical device to relieve the muscles of strain while soaring, — an assumption whose truth seems open to question, as many of the lower animals are capable of automatic muscular movements of very long duration.

Among mammals the cetaceans are almost constantly on the move both by day and by night, while others rest in positions that seem to entail considerable muscular strain. Thus horses very frequently sleep in a standing posture, and the skunk and baboon have been observed to seek repose lying flat upon their backs, with all four legs stiffly extended in the air; a very good example of unrelieved muscular strain may be seen in the tail of the spider-monkey, whose prehensile power is sufficient to sustain the animal after life is extinct; some birds, during their migrations, fly or swim for immense distances without stopping for rest, and there is very good reason for believing that many of the petrels keep on the wing for days and nights together without intermission; many fishes require perpetual motion in order to preserve their equilibrium, while other pelagic forms appear to be on the move for long periods of time without flagging, — all these cases necessitating oft-repeated movements, which call for far more serious strain on the muscles than the mere extension of the wings during the act of soaring.

The strain on the extensor muscles at such a time can be but trifling, compared to the strain on the levators and depressors of such a bird as the albatross, whose weight of nine to fifteen pounds is supported by two levers of the third class, five to seven feet in length; and yet no bird makes longer flights than this wanderer of the southern seas, who has no special device to keep his wings outstretched.

These instances are brought forward, not to disprove the fact that a device to ease the muscles in soaring may not exist, but to show that there is apparently not the slightest need for it.

In regard to the interlocking of the primaries, which unquestionably takes place, is not this the result of their emargination, and consequent failure to glide smoothly over one another, rather than the end to be accomplished by this cutting-away of the feather toward the extremity?

This view of the case is borne out by the fact that the longer, more flexible ulnar border of the primary naturally gives at each stroke of the wing, thus catching in the radial portion of the feather immediately behind it, whether the bird wishes it or not.

Moreover, during the act of soaring, the wing is expanded to its utmost, and the tips of the primaries widely separated, while in a fresh specimen of *Buteo borealis* no locking is possible until the wing is partially closed. This would seem to be conclusive as regards the importance of the locking of the primaries as an aid in soaring; although there remain the facts that some birds who soar to perfection — such, for example, as gulls, cranes, storks, and the frigate-bird — do not possess emarginate primaries, while others, like some owls and flycatchers, have emarginate primaries but do not soar.

Professor Trowbridge's comparison of the wing to a flat card is hardly felicitous, and his statement that it would be in a state of unstable equilibrium but for the locking of the primaries would seem open to serious doubt.

One absolute requisite of a wing is that the anterior margin should be rigid, and the posterior border flexible, — a requirement which is met toward the extremity of a bird's wing by bringing the quill close to the radial margin of the feather, leaving a posterior pliable edge.

Now, if the primaries are interlocked, a rigidity is created toward the ulnar border of the wing, which would thus become more card-like and unserviceable than if the primaries did not lock.

A pertinent question that might be asked of Professor Trowbridge, is, Why, if the "long primaries present a serious resistance . . . when a bird is soaring," do all birds that soar or sail possess just such primaries, while the corresponding feathers in birds which do not soar are short?

One feature in the wings of birds pre-eminent for soaring abilities, e.g., the *Vulturidæ* and *Falconidæ*, has not been touched upon in this discussion, so far as I am aware; and this is the fact that when the wing is extended to its utmost, as it invariably is during soaring, the metacarpus and phalanges are not in line with the ulna, but are bent forward of it. By this arrangement some of the muscles and tendons that ordinarily act in flexing the wing are brought upon the dorsal surface of the bones, and thus have their power of flexion weakened, or possibly even made to aid in the automatic extension of the wing. If, now, a bird with wings thus spread be so killed that there is no perceptible shock or nervous start, the bird may remain with outstretched pinions and sail gradually downward, — exactly such a case as Professor Newberry describes.

In conclusion, I can but regret that I have no facts to adduce that will throw any light on the problem of flight, as it is far easier to find fault with any theory than to suggest a better, and purely adverse criticism must always seem more or less ungracious.

FREDERIC A. LUCAS.

Washington, D.C., Jan. 16.

Binocular Combinations upon Disparate Retinal Points.

EVERY one is familiar with the fact that Wheatstone and many subsequent investigators have explained the binocular perception of solidity by the theory of the 'fusion of images upon disparate points,' as they are called, in the retina. They have generally denied the original possibility of a monocular perception of solidity and distance; and hence, when certain plane figures were stereoscopically combined, the apparent solidity of the resulting single figure suggested its explanation in accordance with what had previously been supposed of the mathematical relation between combination and convergence. Thus Wheatstone's view may be illustrated by the following figure. It is well known that the stereoscopic combination of these figures, although making a plane image only upon the retina and representing only a plane surface externally, nevertheless produces the appearance of a solid body. Previous theories of vision had maintained that single vision took place upon corresponding points of the retina, and double vision upon disparate points.

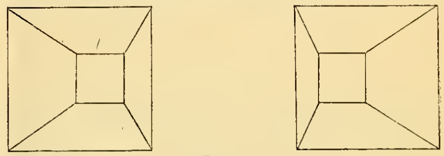

FIG. 1.

Now, as the mathematical construction of the case would not allow the inner figures and lines to fall upon exactly corresponding points, the apparently single character of the image in stereoscopic combination was most naturally explained by saying that fusion took place upon disparate points; and hence when the perception of solidity, or relatively different distances between the larger and smaller figures, uniformly accompanied this kind of fusion, it was naturally ascribed to that process as its cause. Whether such a fusion really takes place or not, has been hotly contested, and we wish here to present a few new considerations to show that it does not occur, notwithstanding the strongest apparent evidence of our actual perception of it.

To make the argument clear, a few words will be necessary upon what is meant by 'corresponding' and 'disparate' points. As indicated, they denote the points upon which respectively single and double vision takes place. But the second term has two very distinct applications, — one binocular, and the other monocular. It is this last fact and its implications which most investigators, and among them Wheatstone, seem to have ignored.

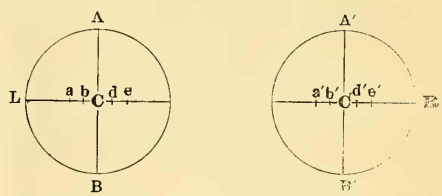

FIG 2.

But the importance of taking it into account will be evident from the following considerations. Take the circles R and L to represent the retinal surfaces of the two eyes. Divide each retina into halves by the vertical meridians AB and $A'B'$. Draw also the horizontal meridians in which lie the points a, b, c, d, e, and a', b', c', d', e'; c and c', at the intersection of the vertical and horizontal meridians, represent the *fovea centralis* of each eye. Now, the vertical meridian divides each eye into halves, that correspond to the opposite halves of the other eye. Thus we have what are called the nasal or inner, and the temporal or outer halves of the eyes. The nasal halves of each eye are said to 'correspond' to the temporal halves of the other eye. How this will appear can be seen by superimposing one circle upon the other; and the points a and b in the temporal half of the left eye, L, will coincide with a' and b' in the nasal half of the right eye, R; and d and e in the nasal half of the left will coincide with d' and e' in the temporal half of the right eye. By calling these 'corresponding' halves, we mean that they have the same function of localization; that is, that they are constructed for seeing the same object, at the same point in space, at the same time, assuming a given state of fixation and the proper position of the object. Thus one image of an object falling upon *a* in the left eye, *L*, and the other upon *a'* in the right eye; or upon *b* in the left, and *b'* in the right eye; and so on, — will make the object to appear single and in the same place. Hence they are called 'corresponding' points. But if one of the images falls upon *a*, and the other upon *b'* or any point between that and *a'*, which may happen ac-

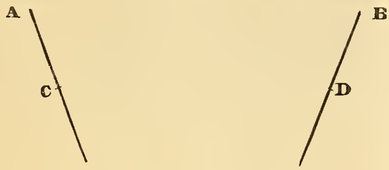

FIG. 3.

cording to the position of the external object, there will appear to be two objects. This is because all other points than *a'* are 'disparate' in relation to *a*. So with *b* and *c'*, or *c* and *d'*. Thus, while every point in a temporal half is a 'corresponding' point to a given point in the nasal half of the other eye, it is 'disparate' to all other points. This is the binocular use of the term. But since the temporal halves of the two eyes are non-corresponding halves, the points *a*, *b*, *d'*, and *e'* are also 'disparate.' Now, in the monocular retina all the points are 'disparate' in relation to each other; that is, combination never takes place. Hence *a*, *b*, *c*, *d*, and *e*, or *a'*, *b'*, *c'*, *d'*, and *e'* are respectively 'disparate' in relation to each other monocularly considered. Then, since the temporal half of the right eye corresponds to the nasal half of the left eye, and the two are thus identical in visual functions, *a* and *d'*, or *b* and *e'*, are 'disparate' in relation to each other in precisely the same sense as *a* and *d*, or *b* and *e*, in monocular vision. This is the monocular use of the term. Now, since fusion of images never takes place in monocular vision (say, when separate images fall upon *a* and *b*, *b* and *c*, or *a* and *d*, and so on), it can never take place when the two images fall upon non-corresponding halves of the retina (say, both upon the temporal, or both upon the nasal halves; that is, upon *b* and *d'*, *a* and *d'*, or *b* and *e'*), any more than they would upon *b* and *d*, *a* and *d*, or *b* and *e*, and so on. The reason for this is plain. Each eye forms binocularly only half an eye, so that the temporal half of one is identical in function with the nasal half of the other. This being the case, the non-corresponding halves of the binocular eye form a monocular eye. Experiment will show this to be the case. Hence stereoscopic images falling both of them in the temporal, or both of them in the nasal halves of the binocular eye, will appear precisely as if one of them fell in the nasal and the other in the temporal half of the monocular eye, or as if both fell upon separate points in any one half of the monocular eye. Thus the images in the temporal halves *a*, *b*, and *d'*, *e'*, can no more combine than if they were *a*, *b*, and *d*, *e*. Hence *a*, *b*, *d'*, *e'*, are monocularly 'disparate;' so also *d*, *e*, *a'*, *b'*. Now, since monocular combination of 'disparate' images never takes place, we can demonstrate that it can never take place in stereoscopic combination; at least, where the figures to be combined are such as Wheatstone's original illustration represented: namely, two lines which indicate opposite inclinations to the median plane. This is shown in the following lines, where *A* and *B*, the upper ends of the lines, will fall upon temporal halves of the retina when *C* and *D* fall upon the fovea, and yet fusion is as apparent as if it were real. The lower ends fall upon the nasal halves, and fusion is also apparent; the total resultant being a line with the upper end nearer the observer than the lower, and apparently upright or at an inclination to the plane of the paper. But it is effected by non-corresponding halves of the eye.

To illustrate this, take Fig. 4, *R* and *L* representing the two eyes. Let *A* and *B* represent two figures farther from the median line *EF* than *C* and *D*. *A* and *B* may represent the upper ends of the lines in Fig. 3, and *C* and *D* the centres; both together forming a plane geometrical outline for a stereoscopic figure such as Wheatstone employed. Take *E* for the point of fixation before combination, so that we may suppose *A*, *B*, *C*, and *D* to lie in the horopter. *c* and *c'* are the *foveæ centrales*; and when the eyes are fixated for an object at *E*, its two images will fall, one upon *c* and the other upon *c'*; while those of *A* will fall upon *e* and *e'*, of *B* upon *a* and *a'*, of *C* upon *d* and *d'*, and of *D* upon *b* and *b'*. Now, *a* and *a'*, *b* and *b'*, *c* and *c'*, *d* and *d'*, *e* and *e'*, being corresponding points, the several objects will be seen single while they are in the horopter; but the position of their images upon the retina must be noticed before indicating the effect of stereoscopic combination. The images of each object fall upon corresponding halves of the retina; but the images of *A* and *B* compared, also of *C* and *D* compared, fall upon non-corresponding halves of the retina. Now, in stereoscopic combination the object is to make *A* and *B*, or *C* and *D*, appear to coincide respectively; that is, appear upon the fovea. This may be done by converging or by diverging the eyes. But this can be effected only by fusing one image of *A* or *C* in the one eye with the image of *B* or *D* respectively in the non-corresponding half of the other eye. By convergence the fusion will be of images at present in the temporal halves; by divergence, of images in the nasal halves: that is, by the former combination, must be of extra-foveal, and by the latter of intra-foveal, images. *a* and *b*, and *d'* and *e'*, are extra-foveal, because they lie in the temporal halves: *d* and *e*, and *a'* and *b'*, are intra-foveal, because they lie in the nasal halves of the eyes. Now, if we converge the eyes so as to bring the image of *C* and *D* into the fovea, it is evident that the combination takes place only by what are extra-foveal images when the point of fixation is *E*. Convergence to produce combination of *C* and *D* requires a new point of fixation in the median line at the intersection of the lines which represent the course of light from *C* to *d'*, and from *D* to *b*. When this is effected, the foveæ *c* and *c'* are shifted, the former to *b* and the latter to *d'*, to receive the images at those points. But thus, while the images of *C* and *D* are fused in the

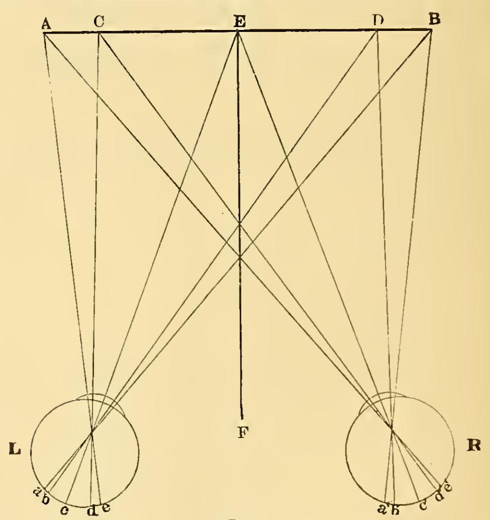

FIG. 4.

fovea, those of *A* and *B* still fall upon extra-foveal points as far from the new position of *c* and *c'* as *a* is from *b*, and *e'* from *d'*. But being both extra-foveal, they fall in temporal and therefore non-corresponding halves of the retina. In Wheatstone's experiment, Fig. 1, these would represent the larger squares, and the apparent combination represented in the base of a visibly solid figure thus perceived is explained by 'fusion upon disparate points.' But being extra-foveal, and in the temporal or non-corresponding halves of the retina, these points are not binocularly, but monocularly 'disparate,' and hence the fusion claimed for them is as impossible as if it were claimed for the points *a* and *b*, or *a* and *e*, or any two points in monocular vision. Images upon different sides of the fovea in monocular perception never combine, and are never supposed to combine. Now, supposing C and D in the foveæ e and c' by convergence, and keeping in mind the fact that the temporal half of the right eye in binocular perception corresponds to the nasal half of the left in monocular perception, the images of A and B, while they fall in non-corresponding halves, occupy positions visually the same as if they fell upon non-corresponding halves in monocular perception, the temporal and nasal; and hence, superimposing L upon R, e' would fall as far from the fovea in the nasal half as a from the fovea in the temporal half of the left eye L: that is, the images of A and B, a and e', visually fall upon opposite sides of the fovea, and can no more combine than separate images in monocular perception.

The same general result is obtained if we combine C and D by diverging the eyes; that is, by focusing the eyes in the median line beyond the point E, or beyond the stereoscopic figures. The eyes are thus turned outwards, so that the fovea in each case must be shifted inward from c to d, and from c' to b'. Combination of C and D will thus be attained by intra-foveal images, — such as are intra-foveal while the point of fixation remained at E. But when d and b' are brought into their corresponding fovea, e and a' still remain intra-foveal at distances from the fovea equal to that between d and e, and a' and b'. By the same argumentation as before, it can be shown that the images of A and B, respectively e and a', cannot combine. Thus, being both intra-foveal, they fall upon points in the nasal halves of the two eyes. These are binocularly non-corresponding, and therefore monocularly complementary halves of the retina: hence falling upon e and a' in binocular vision is the same as occupying opposite sides of the fovea in monocular vision, and so combination will be impossible. This shows the importance of observing what is implied by the term 'disparate.' As long as we conceive the term in its binocular application, there would be some reason for supposing combination upon them under the circumstances described. But adjustment by convergence and divergence, the former for extra-foveal and the latter for intra-foveal images, requires us to think of 'disparate' in its monocular application; and in that case we must either deny the possibility of combination upon them, or abandon the whole theory which makes a nasal half of one eye correspond to a temporal half of the other; for, if 'disparate' points in monocular perception may admit of combination, a nasal half may correspond to a nasal half, and a temporal to a temporal half, of the retina. This has never been assumed to be possible.

Of course, 'intra-foveal' and 'extra-foveal' are used with reference to the vertical meridian, and not the horizontal meridian, as Fig. 4 would seem to imply. In the last figure A and B represent positions relative to the vertical meridian of any objects in the temporal halves of the retina, and hence they may be above or below the horizontal meridian in which they really lie, according to the inclination of the lines to the median plane. The modification for the nasal halves of the retina can be supplied by the reader. It is evident from this that this demonstration does not apply mathematically to Fig. 1, where the apparent fusion is of binocularly 'disparate' points, although, taken in the *total* sense for *localization*, it will apply. But it is combination, not localization, that we are discussing.

If the stereoscope is used to effect the combination, the perspective noticed in convergence with the naked eyes is reversed, and is identical with that effected by the divergent movement to produce combination. The reason for this may be briefly stated. The partition between the lenses lies in the median line, and hence cuts off the extra-foveal images entirely. Combination has therefore to be effected by the intra-foveal. With this statement of the conditions, the argument could be carried out as before.

But the reply to our position that stereoscopic combination upon 'disparate' points must be impossible, will be the very plain one that it contradicts the *facts* of actual vision; that we can actually see the combination to have taken place; and, since it cannot have been upon corresponding, it must have been upon 'disparate' points. There are two replies to this, and, in addition, an important fact which explains the apparent anomaly. In the first place, the demonstration is mainly intended to show that the phenomenon must be impossible if we still retain the ordinary theory in regard to the divisions of the retina and their functions. In the second place, experiment shows that our claim is correct: for, after long practice in combination by convergence or by divergence, those images which, according to construction, must fall upon disparate points, and which at first seemed to be single and to coincide, appear double until they are brought into the fovea. This indicates that they were never really fused into one. Why, then, is the fusion so apparent to vision? The answer is, that inhibition had suppressed such portions of one or both images contending for fusion, that the resultant, made up of complementary elements, appears as a single image. After considerable practice, the reflex and automatic tendency is weakened, and inhibition correspondingly decreases; so that the images which before seemed single appear double, as the law of disparate points requires.

Baltimore, Md., Jan. 4. J. H. HYSLOP.

Bacteriology as a Study in Schools.

THE subject of the study of bacteria, discussed by Professor Conn in a recent number of *Science* (xi. No. 257), is one which deserves more attention than it has attracted thus far, and I take the liberty of making a few suggestions which have presented themselves to an investigator rather than a teacher, but which may prove useful to the latter. Let us call the subject 'bacteriology' for convenience' sake, and drop the misleading expression 'germ-theory of disease,' which has had its day. We know, as positively as we know that the earth revolves on its axis, that certain diseases in man and animals are caused by the invasion and multiplication of bacterial parasites. There is no theory about this. The phrase is misleading, because it states that all disease may be due to germs, which is manifestly untrue.

There are several classes of students who would be greatly benefited by a careful study of bacteria in the laboratory.

1. Students of general biology and physiology would gain by a few simple experiments, readily performed, a very clear insight into the great metabolic activity of life in general, of bacteria in particular. It would be easy to demonstrate the formation of soluble ferments related to pepsin and diastase; the production of soluble and insoluble pigments, and the effect of re-agents upon them; the relation of vital activity to oxygen as expressed by aerobic and anaerobic germs; the effect of bacterial growth on various substances, such as blood serum, gelatin, and milk; the resistance of spores to high temperatures; the effect of disinfectants and antiseptics; the phenomena of phosphorescence, nitrification, and other equally interesting and instructive features of bacterial life. The habit of close observation and careful differentiation may be cultivated by the parallel study of two species as nearly alike as possible. All this, and more, can be done with bacteria obtainable at any time, from natural waters, from the soil, the digestive tract of mammals and other animals, from milk and various infusions. To impress the mind with the destructive effect of pathogenic forms, a rabbit, or mouse, or guinea-pig may be inoculated with some germ fatal to these animals, but harmless to man. Such a form, fatal to rabbits, is occasionally present in the mouth. The microscopic study of bacteria brings out facts of histo-chemistry, and features of the microscope itself hitherto scarcely known, which should be applied in ordinary histologic work.

2. There is another class of students who stand in need of such instruction. Much of the preparatory work of the student of medicine can and should be done at our higher institutions of learning. For instance, the admirable work done at Cornell University in preparing students for the study of medicine, of which I have personal knowledge, has always tended to push students into the front rank at the medical schools. These have no time to spare to teach students how to dissect well, how to study anatomy or to acquire the methods underlying histologic work and chemical analysis, nor have they the time to teach bacteriology. Yet no one should graduate in medicine to-day who does not know something about the secret working of this miscroscopic world, who cannot reason with it in his practice, or recognize the different forms when a diagnosis may be based upon them. Our biological laboratories may do much to help the medical schools in this direction. The physician will then be equipped with healthier ideas concerning the 'germ-theory;'

and the adverse opinion still expressed upon it by many, which may be safely called the opinion of ignorance, will soon be heard no more.

Another class needs some knowledge of bacterial life. This includes all, — the father, the mother, the teacher, the citizen. Whoever has charge of human life should know something of the nature of infection with its manifold ways, of the necessity of disinfection and the means within reach. Education in such subjects is the only means of strengthening our present lax and indifferent spirit with reference to the public health. For this third and largest class a brief course of lectures, with demonstrations that will impress firmly the reality of the vital force inherent in bacteria, would be amply sufficient. What is needed is a certain attitude, an intelligent receptivity of the younger generations which will be favorable to all proper measures for the protection of public and private health, and which will promote in every way the study of the laws that underlie it.

The teaching of hygiene is taking root rapidly and firmly in the continental universities, and bacteriology is intrusted to such chairs. Our own higher institutions are beginning to realize the need of such instruction. As yet we have not gotten far beyond muscle, but that is a very good beginning. Bacteriology, though linked to hygiene as a branch of study, should, for the time being, find its place without difficulty in the biological laboratory.

THEOBALD SMITH.

Washington, D.C., Jan. 23.

Queries.

25. TREE TEMPERATURES. — In speaking with two farmers, each of more than ordinary intelligence, one last winter and another this, on the subject of temperature, they asserted that a thermometer hung against the trunk of a living tree of any size would not register as low as if suspended (as one made the observation) from a wire clothes-line, and the other from a pine post. Is this a fact?

D. LICHTY.

Rockford, Ill., Jan. 23.

26. THE EARTH'S ROTATION AS AFFECTING RAILWAY-TRAINS. — In Maury's 'Physical Geography of the Sea,' edition 1855, p. 39, paragraph 43 reads as follows: "Take for illustration a railroad that runs north and south. It is well known to engineers that when the cars are running north on such a road, their tendency is to run off the east side; but when the train is running south, their tendency is to run off on the west side of the track, i.e., always on the right-hand side. Whether the road be one mile or one hundred miles in length, the effect of diurnal rotation is the same; and the tendency to run off as you cross a given parallel at a stated rate of speed is the same, whether the road be long or short, the tendency to fly the track being in proportion to the speed of the trains, and not at all in proportion to the length of the road." Now, this article is quoted by many scientific authorities. It goes the yearly round of papers and periodicals. Is it true? To prove or disprove it, I have sent out a circular letter, to get from those familiar with railroads the facts on the subject. If it is true on a single-track road running north and south, with the same number of trains passing each way, the rails, and flanges of cars, not turned, would be equally worn. On double-track, the east rail north-bound, and west rail south-bound, would be most worn. Cars that were not turned would have their wheels and flanges equally worn; but locomotives, if "the tendency is always to the right," would have their right-hand flanges most worn. To facilitate the inquiry, I ask a list of questions. The questions are not asked for any personal advantage, but as of general scientific interest. 1. Do cars, when running north, have a tendency toward the east? 2. Do cars, when running south, have a tendency toward the west? 3. Have any instances come under your observation that indicate, by any wear of rails, of journals, of boxes, of flanges, or any part of a railway equipment, that "a train going north has a tendency to run off on the east side, but when the train is going south the tendency is to run off on the west side of the track"? 4. General remarks, with detailed description,— evidence *pro* or *con* from engines or rails.

JOHN C. GOODRIDGE, JR.

New York, Jan. 28.

Answers.

21. GLOBULAR LIGHTNING. — Governor Talmadge of Wisconsin lived in a two-story log-house on a level prairie near Fond du Lac, a short distance from a ridge of limestone that rose abruptly from the prairie. The upper story of the house had two rooms, with windows and doors forming a straight line through the house, and also an entry or hall between the rooms. One afternoon, when the windows and doors were open to allow a draught of air through the rooms, a ball, apparently a foot in diameter, floated slowly in one window, past Miss Talmadge, through the hall, and probably out of the other window, as the servant-girl ran screaming from that room. About the same time a barn near the house was struck and consumed. I could learn nothing further that was definite from those who saw the ball, when I reached the house.

T. MCDONOUGH.

Montclair, N.J., Jan. 24.

22. WASP-STINGS. — I have read with interest the items recently published in *Science* on this topic. Forty years ago, when a lad at school in Killingly, Conn. (in that part of the town at present known as Putnam Heights), I learned from schoolmates that any wasps could be handled without danger if one held his breath. I saw the experiment successfully made by many of my fellows, and ventured to make it myself with like results. Since that time scarcely a year has passed without my repeating the trial on wasps that have come in my way. I have never been stung except when I have forgotten myself, and allowed myself to inspire or expire the breath. Sometimes, after throwing the wasp violently away, I have been stung, because it had clung to my finger, and, not observing it, I had breathed. Ordinarily I notice after an experiment a slight feeling of numbness on the part of my hand where the wasp has attempted to sting me. I am accustomed to judge by this feeling whether the wasp was one of the stinging kind. As to the cause, I do not know of any. But many scientific persons have unscientifically refused to believe my statements, or to test them by experiment, because I could not answer their question, 'How do you account for it?' Whether the forced suspension of breathing paralyzes the nerves near the surface of the skin, — whether it stops the capillary circulation near the surface, — or whether its effect is something altogether different, I do not know. Nor do I see exactly how a paralysis of the superficial nerves, or an influence on the surface circulation, would prevent the poison from giving pain after commencing respiration again, provided that the wasp has succeeded in piercing the outer layer of the skin: for if the poison is exuded from the stinger, as I have sometimes seen it, it would act effectively upon removal of the paralysis when breathing is resumed. But my experience seems to lead to the conclusion that the poison does not penetrate at all during the suspension of the breath, but is left on the surface of the skin, and produces only the effect of a faint numbness after its effects begin to be felt through the outer coating. I do not take up this subject as one who has conducted any careful scientific experiments on it. My account of the matter may, however, help, like former articles in *Science*, in interesting experts in physiology to make genuine scientific experiments. One may hope that something important will be discovered in regard to the effect of forced suspension of the breath upon the nerves of feeling, the capillary circulation, or the resistance of the skin to penetration.

W. T. HARRIS.

Concord, Mass., Jan. 29.

23. DROPS OF WATER. — In answer to E. J. Pond's query in *Science* for Jan. 20, it seems to me that the phenomenon is explainable in the same way as the related phenomenon of drops of water on a hot stove; viz., rapid evaporation causes a layer of vapor to surround the drop, and this, by its repulsive expansion, keeps the globule of liquid from touching the hot metal in the one case, and the surface of the water in the other. The small drops that fall from the oar-blade will float a short time before calescing, even when no wind is blowing; the fall through the air apparently setting up evaporation enough to bear up the tiny globule. I have seen them at night, when the air was perfectly still, gleaming like seed-pearls in the moonlight. When the wind is strong, much larger drops will be supported because of the rapid evaporation.

C. M. WIRICK.

Metropolis, Ill., Jan. 24.

BOOK-NOTES.

— 'American Fishes,' a popular treatise upon the game and food fishes of North America with especial reference to habits and methods of capture, by G. Brown Goode, will be ready March 1. The reputation of Professor G. Brown Goode, United States commissioner of fish and fisheries, is a guaranty that the subject has been treated in a masterly manner, and with a close attention to detail, which will make this book the invaluable companion of every lover of fishing in all sections of our country.

— The name of Mark Hopkins has for many years been famous in America for profound scholarship and practical wisdom. Its honored bearer, the president of Williams College, has passed away: and now his son, Mark Hopkins, jun., brings the name once more into favorable public attention as the author of a brilliant new novel. It is a story of American life in Paris and Nice, with picturesque Russian and French accessories, and evinces a wonderful story-telling faculty and cosmopolitan spirit. It appears in February from the press of Ticknor & Company.

— The genuine 'Memoirs of Garibaldi,' written by himself, and extending to 1874, were to be published by Barbéra last month.

— Charles F. Heebner, 5 Gold Street, New York, has prepared and published a manual of pharmacy and pharmaceutical chemistry.

— Another of Prof. N. S. Shaler's articles on the surface of the earth appears in *Scribner's Magazine* for February under the title of 'Volcanoes.' Among the illustrations are a number of very picturesque views of the great eruption in the Sandwich Islands, which have never before been engraved.

— Novello, Ewer, & Co., New York, announce that they will issue in the spring, provided the number of subscriptions justify the venture, a review of the New York music season of 1887–88, by Mr. H. E. Krehbiel.

— Henry Carey Baird has issued this year in pamphlet form another series of brief tracts on some economic questions, which were printed in various journals from 1885 to the present; also an argument of Henry Carey Baird, chairman of a committee appointed by a public meeting in Philadelphia, before the Committee on Ways and Means, March 9, 1876, in opposition to the issue of $500,000,000 30-year 4½ per cent gold bonds for the refunding of an equal amount of 5-20 bonds; and 'Two Roads, — the One leading to Civilization, Prosperity, and Happiness; the other, to Barbarism, Rebellion, and Societary Anarchy,' being an open letter to the President of the United States and Mr. ex-Speaker Carlisle.

— Messrs. T. Y. Crowell & Co. announce two new books by Tolstoï. The first contains a number of his fascinating short stories for children, rendered from the original by Nathan Haskell Dole. Crisp, quaint, and artistic, dramatic and tender, often with a quiet touch of humor, always with a moral, not preached nor obtrusive, but which appeals to the simplest understanding, these fables and stories show Count Tolstoï in a new and surprising light. The second is Count Tolstoï's latest work, 'Napoleon and the Russian Campaign,' and will appeal especially to all who are interested in historical literature.

— Mr. George Kennan, the Siberian traveller and writer, has been black-listed by the Russian Government, and will not be permitted to re-enter the Czar's dominions. "I expected, of course," says Mr. Kennan, "to be put on the Russian black-list. I am only thankful that I succeeded in crossing the frontier with all of my material and papers coming this way. The outside of the Russian frontier line is a good enough side for me at present. I became satisfied before I got half through Siberia that I should never be permitted to go there again, and that after the publication of my papers no other foreigner would be allowed to make investigations there, and I lost no possible opportunity to secure accuracy and thoroughness. I brought back more than fifty pounds of notes, papers, and original documents, many of the latter from secret government archives, besides five hundred or six hundred foolscap pages of manuscript prepared for me by political exiles in all parts of Siberia, and covering the most noteworthy episodes in their lives. I visited every convict-mine in Siberia, and every convict-prison except one, and I believe I know the exile system better than most officers of the exile administration, and far better than any outsider. I can regard the black-listing, therefore, with a certain degree of complacency. The stable-door is locked, but the horse has been stolen — and I've got him." — *N. Y. Tribune.*

Calendar of Societies.

Boston Society of Natural History.

Feb. 1. — E. O. Jordan, Beginnings of Natural History in America.

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SCIENCE

FRIDAY, FEBRUARY 10, 1888.

THE ANNUAL REPORT of the New York State Department of Public Instruction has been laid before the Legislature by Superintendent Draper. It contains some very interesting statistics and observations. It appears that the department expended during the year, $14,461,774.94, and this sum does not include the payment to Cornell University, the expenses of the regents, or the appropriations to academies; so that even this enormous sum does not fully represent the State expenditure for common schools. Over 31,000 teachers were employed, and only 5,821 of them were males. The average annual salary of a teacher is, in the cities, $687.12; in the towns, $262.44. The number of children of school age was 1,763,115, and the total enrolment was 1,037,812. The average attendance was only 625,610. The superintendent points out that the uneducated class is increasing, and that the attendance in the schools does not keep pace with the growth of the population. The shortcomings of the present compulsory Education Act are pointed out, and some excellent suggestions are offered as to the best way to remedy the difficulty. On the subject of manual training, Mr. Draper seems to be conservative, but still open-minded, and ready to recommend whatever is proven to be desirable. He says, "There has been much discussion during the year relative to the introduction of manual training as a regular branch of public-school work; and several cities, notably New York and Albany, have undertaken a thorough trial of the experiment. It is much to be hoped that it may prove a wise undertaking. There will hardly be two opinions as to the advantages of industrial training, but it must be demonstrated, upon actual trial, that it can be made a part of our common-school work with advantage to pupils, without detracting from the old-fashioned and essential work, . . . before it should be generally taken in hand by the school authorities. The experiments which have been entered upon will be watched with much interest. The test will be a severe one, but it must be met successfully, by a trial in good faith, before the already over-full courses of study in the schools should everywhere be opened to admit what is commonly called industrial training. There is a common misapprehension in this connection. Manual training need not be confined to carpentry work with boys, or making aprons and dresses with girls. Free-hand or industrial drawing may train the hand and the eye more effectually than handling a saw or a needle. It is easily taught, it is inexpensive, and it is practicable. It is the best possible preparation for further manual work. Every school in the State may undertake this without difficulty, and with good promise of excellent results, and then safely wait for the verdict of those who are further experimenting upon the subject. . . . The mission of the public schools is to best prepare the greatest possible number of children for the activities of life, for social and industrial relations, and for the responsibilities of citizenship under such a government as ours. The few must not be favored at the expense of the many. The beginners must have the most care and the best work. What is done must be practical. A philosophy is of small use unless it materializes. Children must be evenly educated in all directions. Just what shall be taught in detail, must depend upon what, in a practical way, promotes the end for which the schools are maintained at public and general expense." After a survey of the field of educational work, Mr. Draper is able to express a favorable judgment on what is being done, and concludes thus: "There seems to be unmistakable promise of an educational re-organization and revival in this State. Public occurrences during the year have forced the subject upon the attention of the people. Our supervisory officers and teachers are coming more and more to realize the importance, as they are striving more and more earnestly to accomplish the organization of a comprehensive, symmetrical, and harmonious State educational system, in which the district schools, the union schools, the high schools, the academies, the normal schools, and the colleges and universities, shall have their appropriate place, and shall not rival or antagonize, but arrange their courses of instruction so as to support and supplement each other, and work intelligently together for a common and beneficent purpose. The fact must be hailed with universal and unfeigned satisfaction among all our people. The promise must become a realization, if our magnificent commonwealth would maintain her foremost position in the sisterhood of States."

THE DEATH PENALTY.

IT will be remembered that the Legislature of the State of New York in 1886 passed an act providing for the appointment of a commission "to investigate and report at an early date the most humane and practical method known to modern science of carrying into effect the sentence of death in capital cases." The commission, consisting of Elbridge T. Gerry, Matthew Hale, and Alfred P. Southwick, has just made its report to the Legislature. Immediately after its appointment, the commission met, and carefully considered the general outlines of the subject, and also examined the entire criminal law, from its earliest history down to the present time, as to the principles upon which the infliction of capital punishment was based, the methods of execution and the reasons therefor; and in its report, which consists of a pamphlet of one hundred pages, it gives a history of the law, beginning with that of Moses. Letters were sent to sheriffs, physicians, and judges, requesting their opinions as to the present modes of punishment, and inviting suggestions. To these letters two hundred answers were received, and, after their perusal and a careful study, the commission decided that electricity was the best means for effecting capital punishment.

The advantages claimed for electricity are, that death is instantaneous upon its application, and that resuscitation is impossible. For the administration of electricity to a criminal, all that would be essential would be a chair with a head and foot rest, in which the condemned could be seated in a semi-reclining position. One electrode would be connected with the head-rest, and the other with the foot-rest, which would consist of a metal plate. The expense of such a chair would not exceed fifty dollars. If the current of electricity is supplied from the electric-light wires, there would be but slight expense incurred to make the connection from the chair with the wires on the outside. An independent application would cost between two hundred and fifty and five hundred dollars.

The commission concludes its report with the following recommendations: that the death penalty must be inflicted by causing to pass through the body of the convict a current of electricity of sufficient intensity to cause death, and the application of the current must be continued until the convict is dead. The execution must take place within the walls of the State prison designated in the warrant, or within the yard or enclosure adjoining. It shall be the duty of the warden to be present at the execution, and to invite the presence of a justice of the Supreme Court, the district attorney, and sheriff of the county in which the conviction was had, together with two physicians and twelve reputable citizens. Besides one, or, at most, two clergymen, and seven assistants or deputy-sheriffs, no persons other than those mentioned shall be permitted to be present. Immediately after the execution, a post-mortem examination of the body of the convict shall be made by the physicians present at the execution, and their report in writing, stating the nature of the examination made by them, shall be annexed to the certificate, signed by all the persons witnessing the execution, that the sentence was duly carried into effect in accordance with the requirements of the law. After the post-mortem examination, the body shall be delivered by the warden, for the purposes of dissection, to some public hospital or incorporated medical college within the State; or the body may be interred in the graveyard or cemetery attached to the prison, with a sufficient quantity of quicklime to promptly consume it. In no case shall the remains be delivered to any relative or friend; and no account of the details of any such execution, beyond the statement of the fact that the convict was, on the day in question, duly executed according to law at the prison, shall be published in any newspaper.

EXPLORATIONS IN THE DOMINION OF CANADA, 1886.

THE government of the Dominion of Canada, as well as those of the several provinces, are actively engaged in explorations and surveys, and a large amount of material is continuously being added to our knowledge of British North America. In the year 1886 work was in progress in all parts of the Dominion.

In British Columbia Mr. A. Bowman continued his explorations in the Cariboo district. He left Victoria on the 23d of June, accompanied by Mr. James McEvoy as geographical assistant, and on July 3 the party was ready to start into the field. While in 1885 the roads and trails were measured, and the centrally situated mountains were occupied as triangulation stations, geological researches being subordinate to geography, in 1886 great attention was paid to geology. The Goose Creek Mountains and the Selkirk Range, where there are no trails, were traversed with shoulder-packs, relying on the rifle to a considerable extent for supplies. A micrometer measurement of the great Quesnel Lake was carried out, with the aid of a large Chinese boat and an Indian canoe. Bear and Swamp River Mountains and the Dragon Creek Mountains were ascended with a single pack-horse, relying on the axe for progress, instead of a trail. The geographical work was completed by occupying with the transit all the necessary outlying stations, and by measuring with the steel tape two independent base-lines, which will be used as the foundation of the whole of the work.

Farther east, in the Rocky Mountains, Mr. R. G. McConnell has continued previous work in the vicinity of the Canadian Pacific Railway. Work was commenced on the 24th of May, at the gap of the Bow River, and during the course of the summer all the subordinate ranges lying between that point and Gold City were ascended and examined. Although the work was principally geological, our knowledge of the topography of the region was considerably increased, a number of sketches and cross-bearings having been taken from the summits of most of the mountains ascended.

In the district between the Bow and the North Saskatchewan Rivers, J. O. Tyrrell and D. B. Dowling were exploring. Here geology was also the prime object of the expedition; but incidentally the limits of prairie and wooded country in that district have been determined, and careful barometric readings have been taken at numerous points throughout the area examined, in order to lay down on the map approximate contour-lines.

A. C. Lawson continued his researches on the country east of the Lake of the Woods, principally mapping Rainy Lake and the adjacent territory. The main achievement of the season of 1886 was the connection of the township surveys on Rainy River by way of the Manitou canoe route with the Canadian Pacific Railway, and of the canoe route from Lake of the Woods to Rainy Lake.

Of great importance is A. P. Low's and J. M. Macoun's survey of Berens River and Deer Lake. On the 28th of May the mouth of Berens River, on Lake Winnipeg, was reached. Here, having purchased canoes, the season's work was commenced. From its mouth the Berens River was found to trend for one hundred and two miles south of east to Family Lake. Throughout this distance its course is broken by numerous small falls. At Family Lake the river bends sharply to the north, and the survey line runs in a slightly north-of-east direction to the height of land, passing through several lakes. Here the party reached Severn River by a short portage, and followed the stream in a north-east course. On the 19th of June, Deer Lake, which was in part surveyed by Cochrane in 1882, was reached. Descending its outlet for one hundred and seventy-five miles, another large lake was reached, the shores of which were covered with a fair growth of timber. This is called Favorable Lake. Following the river, running out of it for one hundred miles, a larger lake, called Sandy Lake, was entered. After one hundred and fifty miles more, Severn Lake was reached, whence the party proceeded to the Hudson Bay post on Trout Lake, and down Fawn and Severn Rivers to Fort Severn on Hudson Bay. The party then proceeded along the coast to York Factory, and returned, ascending the Hayes River route, to Norway House.

Another extensive journey was accomplished by Dr. Robert Bell. After a brief visit to Manitoulin Island, he went to Sault Ste. Marie, where he hired six *voyageurs* for his northern exploration. These, and the outfit of the expedition, were conveyed to Wabigoon Tank, on the Canadian Pacific Railway, and hence transported over a portage to Sandy Lake, from which the expedition was to start. Leaving the portage on the 6th of July, the general course of the route was north-eastward towards Cape Henrietta Maria, on Hudson Bay. The party first proceeded to Lonely Lake by way of Minnetakie Lake and its outlet. Having descended the upper part of the Albany River, Bell crossed the country northward to the Attawapishkat River, which he descended to the sea. Then he coasted southward on the west side of James Bay until the Albany River was reached. He ascended this river, and its tributary the Kenogamin River, to its source, whence he reached the Canadian Pacific Railway. The whole course from Long Lake to the junction of Albany and Kenogamin Rivers, with the exception of the coast of James Bay, was surveyed. The distances were ascertained by a boat's log, or by the time occupied in traversing them at a known speed, while the bearings were taken by compass. Observations for latitude were made almost every day, and the variation of the compass was also frequently ascertained.

The following part of Dr. Bell's description of his journey is of general interest, as it contains much new information: —

"On arriving at the Attawapishkat, I left my stores and large canoe in charge of one man on an island which I called Nolin's Island, and proceeded with the other men to examine the upward course of the larger stream for some distance previous to descending it to the sea. At about eleven miles above Nolin's Island we reached the lowermost lake of the Attawapishkat, which, the Indians informed me, bears the same name as the river itself. It lies diagonally across the course of the river, and has a length of about nine miles from south-west to north-east by four miles from south-east to north-west. Two miles above Attawapishkat Lake we entered a beautiful lake of much larger size, which, having as yet no distinctive name, I propose to call Lake Lansdowne, in honor of the governor-general of the Dominion. This lake proved to measure about thirteen miles from south-east to north-west by about ten miles from south-west to north-east, and it is the largest sheet of water connected with the river. It contains many large islands, and is much indented with bays. The surrounding country is more or less undulating and hilly, and thus affords a pleasing contrast to the level and monotonous character of nearly all the rest of the region explored during the season. The commencement of the upward continuation of the Attawapishkat River is found in the south-western bay of Lake Lansdowne. This part of the river is described by the Indians as being broad, having, for the most part, a sluggish current, and expanding occasionally into small lakes.

"The Attawapishkat River proved to be somewhat smaller than the Albany, which is not far from the size of the Ottawa above the capital. It descends at an almost uniform rate all the way from Lake Lansdowne to the sea, — a distance of several hundreds of miles. In this distance we did not require to make a single portage, and, from the description of the river above the lake, it would appear to be navigable without portages almost to its source, which has probably an elevation of more than one thousand feet above the sea. Where it flows over the limestone country it is broader and shallower than in the higher parts of its course.

"The seacoast between the Attawapishkat and Albany Rivers is very low and uniform in outline, and without indentations. The water is so shallow that we could touch the bottom with our canoepaddles at from half a mile to one mile from the shore. In order to pass the bowldery reefs, which extend from the shore north of the Albany, we were obliged to go so far out from the land that the tops of the trees were barely visible at the highest places.

"A careful track-survey of the Albany was made from its mouth to The Forks, which, with that of the upper part, also made during this season, when plotted, will enable me to map the whole course of this river, an actual survey of the intermediate portion having been made by myself in 1870. This river possesses additional importance from the fact of its constituting part of the northern boundary of the Province of Ontario."

Dr. Bell's assistants, Messrs. Macmillan and Murray, made a track-survey of part of the Albany River, leaving Bell's party at the lowest point reached by him on the Albany River.

E. Coste completed, with the assistance of J. White, a map of the Madoc and Marmora region, Ontario. We can only mention the surveys of R. W. Ells in the Eastern Townships, near the boundary of Maine, and L. W. Bailey's and R. Chalmers's work in New Brunswick.

Of no less importance are the surveys of the technical branch of the Department of the Interior, under the direction of the surveyor-general, Capt. E. Deville. A number of surveys were made near the Canadian Pacific Railway. Otto J. Klotz was put in charge of the survey of the Canadian Pacific Railway from the summit of the Rocky Mountains to Revelstoke on the Columbia River. In his report will be found an interesting table of elevations of mountain-peaks and a description of the country adjacent to that part of the railway. William Ogilvie was engaged in astronomical observations for determining the longitude of Kamloops. J. J. McArthur made an important topographical survey of those regions adjacent to the Pacific Railway which were not explored by Dr. G. M. Dawson on his reconnaissances of the Rocky Mountains. Fred. W. Wilkins was put in charge of an exploratory survey of Lake Winnipeg, of which he made a complete circuit. He gives the length of the lake as two hundred and seventy miles, its width ranging from two to sixty miles. He describes the lake as shallow, rough, and stormy, and navigation as extremely difficult and dangerous. The east coast is studded with reefs, rocks, and rocky shoals. The west coast, though having deep water in some places, is also very shallow, but its coasts are sandy and muddy. Besides this, numerous township and road surveys were made.

In 1885 the country adjacent to the Banff Hot Springs on the Pacific Railway was reserved for public use, and during the last year it has been surveyed, and roads are constructing which will make accessible the numerous sights of this Canadian National Park. In addition to the reservations at Banff, four mountain parks were reserved in 1886, — Mount Stephen and its environment, Mount Sir Donald, taking in the famous loop of the railway, Eagle Pass, and the amphitheatre at the summit of the Selkirk Mountains.

The Department of Marine was not less active in exploring the little-known parts of the Dominion. We reported on the third Hudson Bay expedition, under Lieut. A. Gordon, in No. 252 of *Science*. Commander J. G. Boulton was actively engaged in carrying on his surveys in Georgian Bay and North Channel, the results of which are published in charts of the British Admiralty, and in the 'Georgian Bay and North Channel Pilot,' which contains much interesting information on those waters.

The Indian Department was engaged in surveying and laying out reserves for various tribes, but principally for those of British Columbia; and the descriptions of the reserve commissioners are of some interest.

The provincial government were busily engaged in extending the surveys of the crown lands. The reports and descriptions of the provincial land surveyors abound with information on the townships they surveyed and divided, and we can only point out a few of the more important reconnaissances of outlying regions. In the Province of Ontario, A. Niven surveyed the outlines of seven townships adjacent to Lake Temiscamingue, in the Nipissing district. He found nearly the whole of the outline to be good farming land, the country level and free from stone. Another reconnaissance was made between Rainy Lake and the 49th parallel, from which it appears that most of the country is rough and broken, with occasional valleys of good land.

In the Province of Quebec, W. A. Ashe madé a survey of the Temiscamingue region, and his report on this country agrees with that of A. Niven, who surveyed those parts belonging to Ontario. C. E. Forgues visited the numerous streams emptying on the northern coast of the Gulf of St. Lawrence, and found that they yield a considerable amount of salmon.

The exploration and colonization of the outlying districts, which were considered of no value whatever a short time ago, are progressing rapidly. Railways and colonization roads are being built and pushed forward in all parts of the country, and the newly opened districts becoming rapidly settled.

As our knowledge of Canada makes rapid progress, so the science of geography has been gaining many friends, and geographical problems are discussed by many societies. It is the subject of many papers read before the Royal Society of Canada; and among them, Capt. E. Deville's paper on the best projection for maps of the Dominion of Canada takes a prominent place. The Geographical Society of Quebec publishes in its Transactions a considerable amount of interesting information, and the associations of the Dominion Land Surveyors and those of the Provincial Land Surveyors of Ontario discuss many matters of geographical interest in their annual reports. DR. F. BOAS.

MENTAL SCIENCE.

What the Will Effects.

UNDER this head Professor James (*Scribner's Magazine*, February, 1888) discusses the processes of voluntary action from the point of view of the 'new psychology.' The discussion is in so many respects characteristic of the rejuvenating interest with which this point of view invests the topics that have always occupied the thoughts of reflecting people, that a somewhat full account of the article will be given below, in the hope of inducing those interested in this science to read the original.

The point of advance in the 'new psychology' of the will that Professor James regards as of most value is its reference of all activity to the type of reflex action. The steps between the application of the stimulus and the accomplishment of the re-action may be short and simple, or they may be long and intricate. I may wink instantaneously at a threatened blow, or I may take a long time in deliberating how to act upon the receipt of a momentous letter. In either case the psychic process, which in the most highly developed form becomes conscious thought, is regarded as a means towards an end, — the action, the conduct. Life is an adjustment to the environment, and the new environment is ever developing in complexity and variability of the adjustments that it makes necessary. A certain kind of these adjustments are usually singled out for separate treatment under the term 'voluntary actions;' but the doctrine now generally accepted is that this class of acts has been evolved from the involuntary acts. The distinction is one of degree of complexity and other characteristics, important among which is the characteristic that in the voluntary action the act is foreseen, the idea precedes its execution, while in the involuntary mode of action the act, though perhaps foreseen as a result of remembered experience, takes place not in obedience to this foresight, but "we know what we are going to do only after we have done it." From this it follows that no act can be voluntary the first time it is performed. "Until we have done it at least once, we can have no idea of what sort of a thing it is like, and do not know in what direction to set our will to bring it about." If one attempts to move his ear, the great difficulty is to know what sort of an effort to make, and what is lacking is the remembrance of the feeling of a moving ear. This is the mental material out of which the motion is generated, and the way to proceed is to move the ear passively until we have a tolerably clear idea of the feeling of the ear when it moves, and then attempt to reproduce this feeling. We teach children to write by holding their hands in the proper position, until they know how it feels; and so, in general, unless we have a guide to direct us in the kind of effort we ought to make to secure the desired end, we must more or less trust to a chance success. There is no abstract willing into the void, and without a memory there could be no will. All our most elaborate acts of will depend for their execution on certain physiological co-ordinations, which, in turn, have been evolved in one way or another from the instinctive expressions of our automatic life.

This idea of the intended action is not only necessary for the will: it is a sufficient incentive to it. The class of action to which Carpenter gave the name 'ideo-motor' is really the type of action. To this class belong such movements as those concerned in picking a pin from the floor while talking, or in scribbling with a pencil, or absent-mindedly taking nuts and raisins from the dish during an after-dinner chat. The deliberate eating is over, but the idea of eating as excited by the sight of the dish, "not meeting with any express contradiction, fatally passes over into action." It needs for this no separate *fiat* of the will: it is enough that no positively hindering idea should be there. The familiar dialogue of ideas that takes place when we have the ordeal of rising on a cold morning before us, illustrates the mental process admirably. We think how late it is getting, how much we have to do, how shameful it is to waste time in this fashion, and yet we remain passive and comfortable, allowing the resolution to fade away every time it seems about to pass into effect. How do we ever get up in such a case? "We suddenly find that we have got up. A fortunate lapse of consciousness occurs: we forget both the warmth and the cold; we fall into some revery connected with the day's life, in the course of which the idea flashes across us, 'Halloo! I must lie here no longer,' — an idea which at that lucky instant awakens no contradictory or paralyzing suggestions, and consequently produces immediately its appropriate motor effects." In general, "the sole known cause for the execution of a movement is the bare idea of the movement's execution, and, if the idea occurs to a mind empty of other ideas, the movement will fatally and infallibly take place." The hypnotic subject well illustrates this principle, for it is just because his mind is empty of other ideas that he acts out so promptly and automatically any and every suggestion of the hypnotizer. Normally the mind is full of a host of ideas, and, if they harmonize with the idea that is to lead to action, they will re-enforce and quicken the act: if they conflict with it, they delay it or may prevent its realization altogether. Had we simply called up the idea, 'we have eaten enough,' this would have been sufficient to check the raising of the hand towards the confectionery on the table. This fact of one brain-process interfering with another, physiology terms 'inhibition,' and sees in it no more (and also no less) a mystery than in the fact of stimulation itself. The reason, then, why, with a constant stream of thought passing through one's mind from morning till night, there are so few that lead to action, is because the various things thought of at once meet with contradictory thoughts, and do not conspire with the action. "They are not consented to. 'Consent,' in short, is a word which describes most of our activity far more accurately than 'volition' does." The volition would quite as often consist in refusing this consent. The lack of power to refuse this consent, to call up the contradictory ideas with sufficient vividness, is what characterizes the slave to passion. The drunkard finds himself preparing to drink at the sight of every bottle and glass, not because he does not realize the consequences of his act, but because he does not refuse his consent to it. "This is why volcanic natures like the Mahomets, the Luthers, and the Bonapartes, are usually fatalists. They find themselves bursting into action with an energy at which they are themselves astonished, as if some god or demon had released a spring."

Having thus considered involuntary actions, and the action following upon the volition of consent, there remains the most highly evolved type of actions, such as depend upon the volition of effort. The 'new psychology' naturally rejects the notion that the will is an outside force exerting its influence upon conduct in a very remote and contra-physical manner, and regards the will as bound down by the conditions of nerve-cell and muscle quite as much as are the simpler acts of a sentient being. The effort does not supplant the ideas: it simply enables us to hold them fast, so that they may become vivid enough to make the physical machine obey. When laboring under a passion, the difficulty in acting rationally is not a physical one. It is as easy, physiologically considered, to perform the movements that lead to the fleeing from temptation as those that yield to it. The difficulty is a mental one. It is the difficulty of getting the idea of the rational conduct to stay before the mind at all. The effect of a strong emotional state is to shut out all ideas that do not harmonize with the satisfaction of the emotion. All others are hushed, and allowed no audience. "The cooling advice which we get from others when the fever-fit is on us is the most jarring and exasperating thing in life." If the rational ideas can ever get a hearing, the crisis is past; for with the new ideas come new tendencies to action, that lead away from passion, and so avert the evil. The strain of the will consists in the keeping the attention fixed on such ideas as the better conscience knows to be warranted, and in keeping down the conflicting notions. "Consent to the idea's undivided presence, — this is the effort's sole achievement: its only function is to get this feeling of consent into the mind." And from this view, it is as good a case of willing if I give my consent to the table's moving as to the movement of my own legs. In the one case the consent is so connected with a nervous system (which connection itself is liable to disturbance by disease), that the act follows from the consent: in the other no such connection exists. In principle the two cases do not differ: the mental prerequisite of the willed action is present.

The moral effort, then, that we have constantly to perform in life, is the overcoming of the resistance which certain ideas offer to being attended to at all. The resistance may be internal, as the uncongeniality of the task; or external, as conflicting with the mood of the mind at the moment: for example, the thought of to-morrow's task while enjoying one's self at an evening's entertainment. We almost involuntarily decide not to think of that, and so frighten the spectre away. But the moral act is the attending to the thought under such circumstances, until it results in action. And the free-will controversy from this point of view resolves itself into the amount of effort that it is possible to put forth in the way of holding an unwelcome idea in the mind.

The answer to the question, 'What happens when we exert our will?' is, according to Professor James, that 'we simply fill our mind with an idea which, but for our effort, would slip away.' This at once opens up a host of ethical considerations which are treated not in the usual manner of omitting the really difficult points and dwelling upon the easy ones, but by manfully facing the real question. A few citations must suffice to suggest the tone of the view which the article upholds. The first lesson drawn from the psychology of the will is that "the will has as much to do with our beliefs and faiths as with our movements. It is, in fact, only in consequence of a faith that our movements themselves ensue. We think of a movement, and say, 'Let it ensue. So far as we are concerned, let it be part of reality.' This is all that our mind can do: physical nature must do the rest." This is the method of attaining a belief: we let our mind fill with it, and drive other thoughts out of the field. Were the problems of life perfectly simple, and the lessons that nature teaches perfectly clear and unambiguous, there would be no great difficulty in selecting a view and adhering to it. "But these ostrich-like attitudes are both of them [i.e., that of the dogmatic spiritualist and the dogmatic materialist] getting harder than ever to maintain." "So long as our mind is assailed in two such different ways, it is quite idle to talk of its being passive and will-less until the objective truths shall have written themselves down. They write down no messages which are both coherent and universal." Look at the men who at the present day feel life on all its sides, and yet who are incapable of volition in intellectual affairs, and imagine that there ought to be some sort of truth with which they can remain in passive equilibrium. Their feelings make them shiver at the materialistic facts, while their loyalty to science makes them dread to be dupes of their feelings. "But the men of will do not let 'I dare not' wait upon 'I would' in any such sorry fashion. They choose their attitude, and know that the facing of its difficulties shall remain a permanent portion of their task." "No more in the theoretic than in the practical sphere do we care for, or go for help to, those who have no head for risks, or sense for living on the perilous edge."

A STUDY OF HYPNOTISM. — In the current number of the *North American Review*, Dr. Gilles de la Tourrette, a pupil of Charcot, gives an account of the views of the several varieties of hypnotic sleep which the French school have developed. While the article gives nothing that is new, it is a convenient and authoritative exposition of the work that has occupied so much of the attention of the workers at the 'Salpêtrière.'

HEALTH MATTERS.

THE THERMAL DEATH-POINT OF BACTERIA. — Dr. George M. Sternberg, U.S.A., the well-known bacteriologist, has been for some time experimenting on the thermal death-point of pathogenic micro-organisms. He has published his results in the *American Journal of the Medical Sciences.* All the tests were made with moist heat, ten minutes being the time of exposure to the given temperature. The absence of growth after eight or ten days is regarded by Dr. Sternberg as evidence that the vitality of the test-organism has been destroyed by the temperature to which it was exposed. No attempt has been made to fix the thermal death-point within narrower limits than 2° C., and the lowest temperature is given which has been found, in the experiments made, to destroy all of the organisms in the material subjected to the test. No doubt more extended experiments would result, in some instances, in a reduction of the temperature given as the thermal death-point for a degree or more; but the results as stated are sufficiently accurate for all practical purposes, and permit us to draw some general conclusions: (*a*) the temperature required to destroy the vitality of pathogenic organisms varies for different organisms; (*b*) in the absence of spores, the limits of variation are about 10° C. (18° F.); (*c*) a temperature of 56° C. (132.8° F.) is fatal to the bacillus of anthrax, the bacillus of typhoid-fever, the bacillus of glanders, the spirillum of Asiatic cholera, the erysipelas coccus, to the virus of vaccinia, of rinderpest, of sheep-pox, and probably of several other infectious diseases; (*d*) a temperature of 56° C. (132.8° F.) is fatal to all of the pathogenic and non-pathogenic organisms tested, in the absence of spores (with the single exception of *sarcina lutea*, which, in one experiment, grew after exposure to this temperature); (*e*) a temperature of 100° C. (212° F.) maintained for five minutes destroys the spores of all pathogenic organisms tested; (*f*) it is probable that some of the bacilli which are destroyed by a temperature of 60° C. form endogenous spores, which are also destroyed at this temperature.

THE HERNDON SCARLET-FEVER EPIDEMIC. — During the past year Dr. Klein of England investigated an epidemic of scarlet-fever the origin of which he believed that he could trace to a herd of cows at Herndon. This investigation of Klein demonstrated that the affected animals were suffering from a disease which was communicable to healthy ones, and also to man by inoculation. It was considered to be distinct from cow-pox; and the weight of evidence seemed to indicate that it was scarlet-fever, and that the milk from animals infected with the disease could communicate it to those who drank it. These conclusions of Klein's have been published broadcast throughout the world, and have been generally accepted. Since this report, the agricultural department of the privy council has authorized another expert, Professor Crookshank, to investigate the subject. He has done so, and has made his report. His conclusions differ entirely from those of Klein. He believes that the Herndon disease was not scarlet-fever, but cow-pox; and of course the epidemic, or rather outbreak, of scarlet-fever near London had no connection whatever with the disease which affected the Herndon cows. Which of the two experts is correct, time alone can decide. Dr. Klein is not a novice in investigations of this kind, and is not likely to be led into such a serious error as the report of Crookshank would seem to indicate. Klein saw the affected cows at Herndon; Crookshank did not, and based his opinion solely on the description of the disease as given by Klein and others. The result of the controversy will be watched with interest by the scientific world.

CONTAGIOUSNESS OF LEPROSY. — The question of the contagiousness of leprosy has again been raised by the action of the board of health of Philadelphia in fining a physician one hundred dollars for not having reported two cases of that disease which were under his care. The editor of the *New York Medical Journal*, in commenting on this subject, claims that there is a mass of incontrovertible evidence to be found in medical literature which ought to place its contagiousness beyond question. In the Sandwich Islands the physicians believe strongly in its communicability, and a number of instances are given which confirm this belief. One of these is that of a Belgian priest who lived in the leper settlement for the purpose of nursing and otherwise caring for those who, having the disease, were here isolated. The result is, that the priest himself is now a victim of the disease. The medical attendants of these outcasts will not go near them without having their hands protected by gloves. The editor of the journal quotes the opinions of other writers who agree with him in his views, and refers to the report of the English commission appointed by the Royal College of Physicians in 1867, which holds that leprosy is not contagious. He concludes by saying, "In the face of all this reliable evidence, a reasonable doubt can scarcely be entertained of the contagiousness of leprosy. In its power of contagion, leprosy may well be, as it often has been, compared to syphilis, and, like that disease, it is frequently contracted through sexual intercourse, and is also just as frequently transmitted to the offspring."

EXPLORATION AND TRAVEL.

Stanley's Expedition.

Petermann's Mitteilungen gives a brief review of the events that have taken place in Central Africa since Stanley's departure from the camp at the Yambunga rapids on the Aruvimi. On the 2d of July, Stanley sent news from Mabode, on the Aruvimi, which was brought to Leopoldville by the steamer 'Stanley.' Since the beginning of July the steamer 'Stanley' has made only one trip to the Aruvimi. On the day of her return, Aug. 17, Major Barttelot, who commands the camp at Yambunga, had no news from Stanley. As Tippo-Tip had not sent the promised troops from Stanley Falls, Barttelot was not able to leave his camp and follow Stanley. After a thorough repair of the steamer, the 'Stanley' left Leopoldville on Nov. 15 for Bangala. After her return she will convey Captain van der Velde to Stanley Falls, where he will establish a new station near Tippo-Tip's village. Therefore we may expect to hear of the events on the Upper Kongo towards March.

Unfortunately the King of Uganda has again cut off the connection between Emin Pacha and Zanzibar, and the reason for his hostility is his fear of Stanley's expedition. After the latter had left Zanzibar, the British consul-general had sent a letter to King Mwanga in order to inform him of the object of the expedition. This letter, which reached Uganda in June, fell into the hands of the Arabs, who were hostile to the Europeans who tried to suppress the slave-trade. They presented it to King Mwanga, and read it to him to suit their purpose. They said the letter informed the king of Stanley's intention to attack the kingdom with an army of two thousand men in order to revenge Bishop Hannington's death. The well-known missionary, Rev. Mr. Mackay, tried to disperse the king's suspicion by informing him of the real contents of the letter; but, as he was accused of being himself an ally of Stanley's, he had to leave the country in which he had lived for nine years. On Aug. 2 he arrived at Msalala, on the south shore of the Victoria Nyanza, where the missionary Gordon had a station. The latter, who was agreeable to King Mwanga on account of his relationship to General Gordon, went to Uganda. The king, however, still suspecting Stanley's intentions, made war upon Kabrega, king of Unyoro, who, he feared, would join Stanley in order to gain his independence. The result of this war is not yet known. But in consequence of this war the messengers who were sent to Casati with letters of credit were prevented from reaching him. It will be remembered that two of Tippo-Tip's men were sent in February of last year on this errand. They went from Zanzibar to Tabora, crossed Karagwe, and reached Kasinga, near the Muta Nsige, in the middle of May. They were, however, unable to enter Unyoro, as it was said that Mwanga had attacked the latter with an army of two hundred thousand men. Having staid two months in Kasinga, they returned to Zanzibar, their means having become exhausted.

In December the news was received in Zanzibar that Stanley had reached Wadelai early in September, and that the passage from Mabode to the Nile was extremely difficult. The messenger who carried the report to Zanzibar was not despatched by Stanley, but learned the news from Arabian traders: therefore it is doubtful whether the report is true. The telegraph said some days ago that news had been received by Dr. Schweinfurth in Cairo, but this highly improbable report has been since denied by Schweinfurth himself.

Antarctic Regions. — The British Government has refused the request of the Australian colonies to grant a subsidy to the proposed Antarctic expedition which was to be organized by a joint effort of the Australian colonies in case the British Government should support the undertaking. This decision will probably postpone the resuming of Antarctic exploration for an indefinite time. Although it is not probable that results of great commercial value will be obtained by an expedition of this kind, the scientific objects are so great that this new delay must be greatly regretted.

ELECTRICAL SCIENCE.

Electricity directly from Heat.

Attempts to generate electric currents, by utilizing the fact that magnetic metals lose their magnetic properties when sufficiently heated, have been made for some years. It is only recently, however, that such experiments have been made on a practical scale, and with any promise of ultimate success. When we consider that in the most economical source of electricity, the dynamo-electric machine, we transform the energy of our fuel to the energy of steam under pressure, then through the steam-engine to mechanical work, and finally by the dynamo to the energy of electrical currents, losing energy in each transformation, our ultimate return being perhaps ten per cent of the energy expended; when we add to this the complication and expense of a steam-plant, — it would seem that, even if our means of direct conversion is not so economical as the dynamo, yet if it have any reasonable efficiency, and is simple of construction, it would supplant the older method.

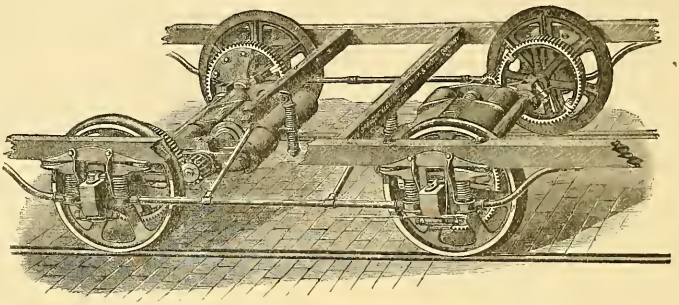
In August of 1887 Mr. Edison read before the American Association for the Advancement of Science a paper on pyromagnetic generators. Briefly the principle on which his machine was built is this. If a piece of iron wrapped with wire be put between the poles of a magnet, a number of lines of force will pass through it, and therefore through the coils of the wire, depending directly on the strength of the magnet and on the magnetic permeability of the iron. Now, it is well known that the permeability of iron becomes very nearly zero when it is raised to a bright red heat: so, if we heat the iron, the lines of force through it will decrease, and this decrease will cause an electro-motive force in the coil of wire. When the iron cools, there will be an increase of lines of force, causing an electro-motive force in the opposite direction. Mr. Edison's machine, built on this principle, consists of eight horseshoe magnets arranged in a circle, the poles facing inward; and between the poles of each is a roll of thin laminated iron covered with asbestos and wrapped with wire: we will call these the armatures. This is placed over a furnace, and beneath it revolves a half-circle of fire-clay, which shields half of the armatures from the heat. If this shield be turned continuously, half of the armatures are being heated while the other half are being cooled; and the electro-motive forces in the two halves, which would be in opposite directions, are added by a commutating arrangement on the shaft of the shield. A blast of cold air assists the cooling of the armatures.

In his paper, Mr. Edison gave no data as to the performance of the machine, except the statement that a generator to feed thirty incandescent lamps would weigh two or three tons.

Nothing has been heard lately of this generator: it will naturally take time to perfect it and make it practical.

Within the last month, however, attention has been called to a machine using the same general principle as that of Mr. Edison, but differing greatly in detail, — an invention of M. Menges of the Hague.

One form consists of a Gramme ring within which is a stationary electro-magnet. The two are horizontal, and are separated by a considerable air space: this space is filled by a zigzag ribbon of iron extending around the inner circumference of the ring, with which it revolves. Now, if this ribbon of iron be cold, most of the lines of force will pass through it from one pole to the other of the magnet: few will go through the armature. If, however, the ribbon be heated at points at right angles to the poles, the magnetic resistance will be increased, and most of the lines of force will pass through the armature: there will be no motion, since every thing is perfectly symmetrical. If, now, the heat be applied to the ends of the same diameter at points forty-five degrees from the pole, the symmetry disappears, and there will be a rotation. Now, the Gramme ring rotating in a field of force will generate currents as in an ordinary dynamo-electric machine. In reality, then, we have a motor-dynamo arrangement, the former transforming the energy of heat into motion, the latter transforming the energy of motion into electrical energy.



THE SPRAGUE STREET-CAR ELECTRIC MOTOR.

Both the 'pyromagnetic generators' of Mr. Edison and M. Menges are an advance on previous machines of this type. It is difficult to see, however, how, in their present form, either can produce any very considerable quantity of electrical energy, with any reasonable size of apparatus. The publication of reliable figures on the performance of these machines would be of great interest.

Sprague Electric Railway in Richmond. — There was opened for traffic on Feb. 2 an electric street-railroad that from the extent of the plant, the difficulties overcome, and the perfection of equipment, marks a decided advance in electric traction. The Union Passenger Railway system in Richmond extends from the eastern to the western part of the town, having a total length of track of eleven miles. The road has many curves of short radius. There are grades that reach ten per cent, while there are combinations of curves and grades even more difficult than the steepest of the grades. In one case there is a thirty-foot curve on an ascent of seven per cent. In addition to this, but a small part of the length is through paved streets, and in wet weather the mud is so bad that in some places it completely covers the rails. The road is equipped with forty large sixteen-foot cars. Beneath each car are two $7\frac{1}{2}$-horse power motors, one geared to each pair of wheels. The current is taken from an overhead wire by a wheel or trolley of sheet brass fixed on the end of a rod which holds it up underneath of and in contact with the wire. This rod is fixed on trunnions, and is fitted with springs that give a gentle pressure at the contact. The motors, nominally $7\frac{1}{2}$-horse power each, are capable of developing over ten-horse power when necessary. They are beneath the car, out of sight, and are geared by a system of spur-gears to the axle of the car-wheels. Each motor is swung in a cradle one end of which pivots on the car-axle, — the axle passing through bearings in the cradle, — while the other end is fastened to the car-frames by heavy spiral springs above and below. These springs are for the purpose of avoiding any sudden strains. Between the gear on the motor shaft and that on the car-axle is an intermediate gearing which is fitted on its axle with rubber cushions to give additional relief from shocks. The whole gear system works easily, and makes very little noise. The switches for controlling the current are on both platforms, the car running in either direction. The coils of the field-magnets of the motors are divided into a number of sections, and the switch makes different arrangements of these coils, putting them all in series (when the current is least) or in parallel (when the current is greatest), or using different combinations for intermediate powers. The cars are under perfect control: they start easily, and can be backed instantly in case of emergency. Brakes are used both for the wheels and on the track, the ordinary wheel-brake not being sufficient for some of the steep grades that occur. Power is supplied from a central station in about the middle of the line. There are six dynamos, giving 500 volts and 80 ampères each. The line was opened for traffic with ten cars running. They were crowded with passengers during the day; and the heavy travel, together with the inexperience of the drivers, was a severe test for the system. There were a few small troubles, but these were soon rectified; and, on the whole, the day's work seemed to prove the system a success.

BOOK-REVIEWS.

Political Economy. By FRANCIS A. WALKER. 2d ed. New York, Holt. 8°.

IT would be superfluous to commend to American readers any economic writing by President Walker. His clear style, vigorous thought, and terse expression have long since placed him in the front rank of economic thinkers, whether American or European. His wide experience and his philosophic insight raise him far above those scribblers of ephemeral pamphlets who are crying now for socialism, now for co-operation, now for *laissez faire*, and all under the name of 'political economy.' President Walker sees very clearly that economics, if it is a science at all, is only to be studied in the ever-varying phenomena of human nature, and he would be the last to attempt to regulate or produce either character or productivity by statute.

The present volume is the best adapted to the present needs of students in the United States, of any that have come from the press. Not only are the general topics of political economy treated fully and with ample illustration, but a concluding part (and a generous one) is given to the discussion of present problems under the head of 'Some Applications of Economic Principles.' We do not follow President Walker in his virtual indorsement of the Ricardian theory of rent, or of Malthusianism; for, despite what he says, both doctrines appear to us to be mere approximations, and not certainties. It is the assumption of their certainty, and the basing of elaborate deductions upon them, which have made so many of the theoretical conclusions of political economy so absurdly at variance with facts. On the wages question President Walker is particularly strong and clear, and his conclusions incontestable. It is interesting to see a professed economist write of the system of protection as the author does. His fellow-economists are given to abuse and the hurling of epithets as soon as the subject is mentioned; but President Walker, in a fairer spirit, writes, "If the protectionist can show that restraints imposed by law upon the industrial action of his countrymen, or the men of any country he chooses to take for the purposes of the debate, have the effect not, indeed, to generate productive force, but to direct the productive force generated by human wants, setting in motion labor with a better actual result than under the rule of freedom, he will make his case. But this is to be proved, not taken for granted; and it is only to be proved by sound and serious argument, not by strenuous exertion and senseless clamor" (pp. 508, 509). This is a position which all rational men can accept; and it is infinitely removed from the line of argument, or rather of invective, pursued by Professors Sumner and Perry. President Walker's argument in Paragraph 615, we do not, however, quite understand; for it seems to imply that the advocates of protection insist on that as a universal fiscal policy with a view to making industrial entities correspond to political ones. As we read their arguments, on the other hand, no such claim is made. It is only asserted that protection is best for the United States at this time. At all events, a free-trade argument on the basis indicated by the writer would be both valuable and interesting.

We cannot refrain from expressing the wish that this book may find its way into more of our colleges, for it is worthy of them.

Nuttall's Standard Dictionary of the English Language. New edition, revised by Rev. James Wood. New York, Warne & Co. 8°. $1.50.

GREAT improvements have been made of late years in concise and handy dictionaries. Those formerly in use contained but a small proportion of the words in the language, and many of the definitions were nothing but synonymous terms; so that, for every purpose of real scholarship, reference had to be made to a large dictionary. But now we have several dictionaries of convenient size and low price, which really serve their intended purpose, and one of the best of these is that now before us. We have not examined the work in detail; but such examination as we have been able to give it shows it to be worthy of the popularity it has already attained. The definitions — always the main point in a dictionary — are up to the level of those in other English dictionaries, and the various meanings of the same word are distinguished with much fulness and accuracy. Illustrative examples from authors are not given, as the smallness of the book forbids it; but there are some pictorial illustrations, though not so many as in some other dictionaries of a similar character. The orthography is that usually employed in England, including the *u* in such words as 'honour.' The pronunciation is indicated by respelling, with only a slight use of diacritical marks, — a method which, for young people and for many older ones, has certain advantages. The present revised edition contains many new words of science and literature, and indicates in a brief way the derivation of the more important words when this is not obvious. At the end of the volume are the usual vocabularies of proper names, and a brief list of proverbs and quotations from foreign languages, with their meaning in English. The type employed in the book is necessarily small, though not so small as in some other concise dictionaries, and it is new and clear. The book is a medium octavo of eight hundred pages, and will be useful to all who wish for a dictionary of this character.

Hand-Book of Volapük. By CHARLES E. SPRAGUE. New York, The Office Co. 12°. $2.

Volapük. By KLAS AUGUST LINDERFELT. Milwaukee, Casper. 16°. 50 cents.

THE bibliography of Volapük now comprises about a hundred books, but, probably for reasons well presented by Professor Bell in *Science* of Jan. 27, very few of these works are in English. The above are two out of the first half-dozen books on the subject in the English language, though many periodicals in this country have given considerable space, especially during the past few months, to Volapükian literature. Mr. Sprague, who appears to be at the head of the movement in this country, gives, in the introduction to his hand-book, a brief history of the new language and of its rapid progress in Europe. He states that it was invented and first published in 1879 by Johann Martin Schleyer, a German priest, whose object was, "first, to produce a language capable of expressing thought with the greatest clearness and accuracy; second, to make its acquisition as easy as possible to the greatest number." He sought to accomplish these ends "by observing the processes of the many languages with which he was acquainted; following them as models wherever they were clear, accurate, and simple, but avoiding their faults, obscurities, and difficulties." The result of his labors is a language whose "rules have the advantage of being absolute, and unburdened with exceptions," as Professor Bell puts it. A clear and attractive exposition of the new language, in small compass, is given by Mr. Sprague, who modestly claims that the most obvious application of it, in the immediate future at least, is for international correspondence, especially commercial correspondence, which is numerically most important. Mr. Linderfelt's little volume presents the subject in an equally attractive though somewhat different manner, being based upon a German work by Professor Kirchhoff of the University of Halle. Each book contains a copious vocabulary, besides exercises in reading and translation.

Management of Accumulators. By Sir DAVID SALOMONS. 3d ed. New York, Van Nostrand. 16°.

IN the last few years it has been recognized that the treatment of secondary batteries has as much to do with their life and economy as the method of manufacture, especially in the 'grid' type of cell now generally used. No one has had more experience in the use of storage cells than Sir D. Salomons, and what he tells us is of great value to those who work with them.

The present edition of the 'Management of Accumulators' is much larger than the two previous editions, the principal increase being in the chapters on installation. The book is in no sense a treatise on accumulators: it gives but a bare and incomplete description of the chemical actions that take place, and does not attempt to describe any form of battery other than the grid type of the E. R. S. Company's pattern. Instead of this, it gives explicit directions for the care of batteries and the installation of an isolated lighting plant, and it gives estimates of the cost of installation under various conditions. The least satisfactory chapter — that on engines, dynamos, and electric motors — fortunately is the easiest dispensed with.

This book will be valuable to all those who have to do with storage batteries: it will possibly be out of date in a couple of years. The storage battery is being constantly changed and developed, but in the mean time it will have done a good work, and it is to be hoped, that, when the practice changes, Sir David will write a new book.

NOTES AND NEWS.

THE annual winter meeting of the Department of Superintendence of the National Educational Association was held in the hall of the Franklin School, Washington, D.C., on Tuesday, Wednesday, and Thursday of this week. An excellent programme had been prepared by President Dougherty, and the number of distinguished educators who delivered addresses was unusually large. The most important topics treated were, 'How and to What Extent can Manual Training be ingrafted on our System of Public Schools?' by Charles H. Ham of Chicago, Superintendent MacAlister of Philadelphia, Superintendent Marble of Worcester, President Nicholas Murray Butler of New York, Superintendent Powell of Washington, and Dr. Belfield of Chicago; 'How can the Qualifications of Teachers be determined?' by State Superintendents Draper of New York, Higbee of Pennsylvania, Finger of North Carolina, Kiehle of Minnesota, Easton of Louisiana. President Eliot of Harvard read a paper on the second day of the meeting.

— The October number of the *Monthly Weather Review* contains an interesting discussion by E. B. Garriott on the movements of high-barometer areas over the North Atlantic Ocean, founded on the daily weather-charts for 1885. In the *Weather Review* for July, 1887, it was shown that a cyclone's movement depends upon its position with reference to anticyclonic areas, and that during periods of high barometric pressure over mid-ocean north of the 40th parallel, storm areas do not follow the usual east-north-east course to European waters, but pursue a more northerly track, or disperse. In order to study the course of cyclones more closely than has been done heretofore, this investigation was carried on, and resulted in the discovery of the following facts. There exists almost continually an area of high barometric pressure south of the 40th parallel, and one of low barometric pressure farther north. Upon advancing from the American coast, areas of low barometer appear to move towards the region of low barometer, and areas of high pressure are apparently attracted to the region of maxima. The latter show a far greater degree of uniformity of movement than the cyclonic areas, their course and velocity being seldom influenced by the cyclonic areas that may precede or follow them. About ninety per cent of these anticyclones pursue a south-of-east course from the American coast, and, upon advancing to the vicinity of the 60th meridian, lose their individuality and become a part of the great anticyclonic system of that region. The average time occupied by the anticyclones of 1885 in advancing from the 90th meridian to the coast was about one and one-half days, this rate of progression being considerably greater than the average velocity of cyclonic areas over that region. As soon as an anticyclone is absorbed by the great anticyclonic system, the latter extends considerably westward, and therefore a cyclone closely following the passage of a high-barometer area takes an abnormal northerly course; and, on the other hand, the greater the period which exists between the advance of the areas from the coast-line, the greater will be the likelihood of the low-pressure area pursuing a normal path over the ocean. As in the normal movement of cyclonic and anticyclonic areas the latter more frequently closely follow and accelerate the forward motion of the former upon passing from the coast, they materially contribute to the greater rapidity of their advance over the ocean. The thorough study of the normal movements of anticyclonic areas over the continent and the western portion of the ocean, and of the relations which exist between high and low barometer areas attending their passage from the coast, will probably enable us to determine with a considerable degree of accuracy the course of cyclones across the Atlantic Ocean.

— It has been generally accepted that the translation of the name of 'Kongo' is 'the country of leopards,' the root *ko* meaning 'the country,' and *ngo* 'leopard.' J. Jankó, in the January number of *Petermann's Mitteilungen*, shows that this translation is not satisfactory, as, according to the rules of the Bantu language, these two words cannot be combined into the word 'Kongo.' He discusses the various forms of this word as found among the tribes of the Lower Kongo, — the Bakongo, who live on the river from its mouth to Stanley Pool; the Bateke, who occupy the regions between the Kuango and Kongo, and the Kongo and Alima; the Babuma, north-west of the last tribe; and the Bayanzi, between Leopold Lake and the Kongo. The Bakongo name of the river is 'Kongo,' that used by the Bateke is 'Songo,' and the Bayanzi say 'Rongo.' All these names are dialectic variations of the same word, the *k* of one dialect becoming *r* and *s* in the others. The meaning of the word in the Bayanzi dialect is 'spear,' and accordingly Jankó explains the name of Bakongo as 'the man with the spear;' the name of the river, as 'fast as a spear.' If this translation should be correct, it seems more probable that the name of the river was derived from that of the tribe. Jankó remarks incidentally that the root *ku* infers a motion, and that it is contained in the names of numerous rivers, such as Kuilu, Kunene, Kuango, Kuanza, which therefore must not be spelled Kwilu, Kwango, etc. It seems probable that the same root may be contained in the word 'Kongo,' and that the meaning 'spear,' which is, according to Jankó, confined to the Bayanzi, is also derived from this root.

— In controlling the movements of domestic animals by the voice, besides words of ordinary import, man uses a variety of peculiar terms, calls, and inarticulate sounds, — not to include whistling, — which vary in different localities. In driving yoked cattle and harnessed horses, teamsters cry 'get up,' 'click click' (tongue against teeth), 'gee,' 'haw,' 'whoa,' 'whoosh,' 'back,' etc., in English-speaking countries; 'arre,' 'arri,' 'jüh,' 'gio,' etc., in European countries. In the United States 'gee' directs the animals away from the driver, hence to the right; but in England the same term has the opposite effect, because the driver walks on the right-hand side of his team. In Virginia, mule-drivers gee the animals with the cry 'hep-yee-ee-a.' In Norfolk, England, 'whoosh-wo;' in France, 'hue' and 'huhaut;' in Germany, 'hott' and 'hotte;' in some parts of Russia 'haitä,' — serve the same purpose. To direct animals to the left, another series of terms is used. In calling cattle in the field, the following cries are used in the localities given: 'boss, boss,' 'sake, sake' (Connecticut); 'coo, coo' (Virginia); 'sook, sook,' also 'sookey' (Maryland); 'sookow' (Alabama); 'tloñ, tloñ' (Russia); and for calling horses, 'kope, kope,' (Maryland and Alabama); for calling sheep, 'konanny' (Maryland); for calling hogs, 'chee-oo-oo' (Virginia). Mr. H. Carrington Bolton is desirous of collecting words and expressions (oaths excepted) used in addressing domesticated animals in all parts of the United States and in foreign lands. In particular he seeks information as to (1) the terms used to start, hasten, haw, gee, back, and stop horses, oxen, camels, and other animals in harness; (2) terms used for calling in the field cattle, horses, mules, asses, camels, sheep, goats, swine, poultry, and other animals; (3) exclamations used in driving from the person domestic animals; (4) any expressions and inarticulate sounds used in addressing domestic animals for any purpose whatever (dogs and cats). References to information in works of travel and general literature will be very welcome. Persons willing to collect and forward the above-mentioned data will confer great obligations on Mr. Bolton. He is already indebted to many correspondents for kind replies to his appeal for the 'Counting-out Rhymes of Children,' the results of which have been published in a volume with that title (London, Elliot Stock). To indicate the value of vowels in English, please use the vowels-signs of Webster's Unabridged, and in cases of difficulty spell phonetically. All correspondence will be gratefully received, and materials used will be credited to the contributors. Address Mr. H. Carrington Bolton, University Club, New York City.

LETTERS TO THE EDITOR.

**** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

Twenty copies of the number containing his communication will be furnished free to any correspondent on request.

The editor will be glad to publish any queries consonant with the character of the journal.

Weather-Predictions.

MR. CLAYTON'S letter on weather-predictions, in the last *Science*, furnishes a very interesting comparison. I find in the Bulletin of the New England Meteorological Society for October, 1887, Mr. Clayton's interpretation and verification by his own rules of the government predictions. These are made generally for the whole of New England, but it is to be presumed that he has made a fair estimate so as to give a comparison with his own predictions for south-east New England. He gives the Signal Service 58 per cent, and himself 85 per cent. It now appears (see *Science*, Jan. 27) that precisely the same predictions, stripped of all ambiguity and narrowed down to a definite locality (Boston), give, by an application of the same rules, 96 and 80 per cent respectively. This striking difference of 43 per cent, in the application of the same rules of verification, shows the absolute need of a fair comparison in weather-predictions, and that, too, between similar things. X.

The Snow-Snake and its Name.

AS my notes on the snow-snake were written partly to elicit information, and partly to point out an anachronism, I am glad to receive so early a reply. I objected, by implication, to the use of misleading terms for what is probably an old game. I am also aware that a Southern Iroquois nation, for over one hundred and seventy years past resident in New York, now has the snow-snake and a name for it; but I did not and do not think the Southern winters appropriate for the game. The description to which I referred was in every way erroneous, and yet was made to have an historic air. But I wished also to learn the extent to which the game was played, North and South, East and West, and it is pleasant to be assured that it "was a favorite out-door sport of the Carolinian and Virginian tribes of Iroquois." I would esteem it a personal favor if Mr. Hewitt will kindly furnish quotations descriptive of its early use south of the James River. They will be prized by me and others, having escaped our attention.

A more important question is raised by Mr. Hewitt. My orthography of the word *ka-wher-tah* needs no correction, as spelling and pronunciation were given me by living Onondagas, not taken from lifeless books. But the point, rather incorrectly stated by Mr. Hewitt, is worthy of attention. It is not the case, as he says, that the letter *r* "does not occur in the speech of the Onondagas of the present time," but it certainly has become obscure and rare. In all our early records the letter is frequent: Zeisberger employed it largely in his Onondaga dictionary; in Schoolcraft's vocabulary I think it is found only in the numerals; among the present Onondagas it occurs but sparingly in proper names and other words. Some time ago my Onondaga friend, Sa-go-na-qua-der, sent me a version of the Lord's Prayer in that language. He was not sure of his spelling, and wished me to revise it with him when next at his house. The letter in question frequently occurred, but the sound was obscure. I went over the version with him syllable by syllable, to get the exact sound, and retained the letter four times as clearly enunciated.

It is probable that some Onondagas have given up the letter altogether, while others retain it, and this would account for variations in orthography. My work for many years has been mainly on the early history and customs of the Onondagas, and notes on their language have been but incidental. I am now offered assistance by them in this, and, if I can carry out a contemplated plan will pay especial attention to the question brought up by Mr. Hewitt. Until I have more original data, it would be out of place, for me to do more than justify my present use. The point is debatable, in a sense, but will require some critical research if we are to know the exact extent which the change has reached.

W. M. BEAUCHAMP.

Baldwinsville, N. Y., Jan. 30.

The Occipito-Temporal Region in the Crania of Carnivora.

IN the Proceedings of the Academy of Natural Sciences for 1886, p. 36, I briefly described, under the name of the post-tympanic bone, an ossicle which lies over the squamosal and opisthotic bones in *Ursus*. I have since examined *Amphicyon*, *Dinictis*, and *Archælurus*. I find that the inferior surfaces of the conjoined bones above named exhibit appearances which resemble those seen in *Ursus*, and make it probable that a post-tympanic bone of larger size than the ursine ossicle was present in these genera. Apart from the bone itself, it is noteworthy that the details in the structure and proportions of the squamosal and opisthotic, as they unite to form the post-tympanic process, afford characters by which these genera can be identified.

I have also found that the species of extant *Felidæ* can also be separated by characters of the tympanic bone, especially by the shape of the tympanic ring, i.e., the part of the tympanic bone in advance of the septum. HARRISON ALLEN.

Philadelphia, Feb. 7.

Monocular versus Binocular Vision.

THERE is an interesting phenomenon which is new to the writer, and which very beautifully illustrates the prevalence of monocular over binocular localization. This explanation which we suggest may or may not be true, but it will certainly lead the way to a better comprehension of the fact in case it cannot be accepted as we explain it. We mention the phenomenon as much to ascertain whether it can be verified by others as to point the way to its explanation. It certainly has an interest in the question regarding the perception of distance and the localization of images in stereoscopic combination.

Take two circles, as in Fig. 1, and combine them by crossing the eyes in the ordinary way. We shall see, as is well known, three circles in the field of view, the central one the combined result of two images, and apparently nearer to us than the other and exterior circles, and nearer also than the sheet of paper upon which they are drawn. It is possible that to some experimenters the central circle does not seem nearer than the other two: to the writer it always does. If we combine them by fixating the eyes beyond the plane on which they are drawn, the central circle will appear larger and farther off than the other two. So much, however, is not new, but it is a necessary preliminary to the singular phenomenon which we have not noticed in any investigation of binocular vision. It is also known that the observer can place a pencil or pin point at the apparent location of the central circle, and it will seem to coincide with it, and there is no hesitation in placing it at a point between the sheet of paper and the eyes.

But now, if we take a fine piece of wire, a knife-blade, a needle, or a sharp pencil-point, such objects being used in order to get double images more easily, and place it a short distance farther off than the apparent position of the central circle while we keep the attention upon some point of the circumference of the circle, at a very short distance beyond the point of fixation the needle or piece of wire will appear double, and represents the ordinary homonymous images, which are the images localized beyond the horopter. We may increase this distance of the needle from the point of convergence, and the distance widens as usual between the images. There is perhaps nothing new in this fact. But if we keep the convergence of the eyes perfectly fixed for the combination of the two circles to form the central one, and turn the attention to the two homonymous images apparently beyond the point of convergence, and without allowing the convergence to change so as to combine the images of the needle, we shall find, by very close attention, that they will instantaneously spring into the position of heteronymous

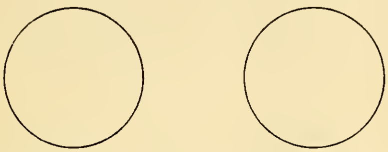


FIG. 1.

images, nearer the eyes than the circle, and without either becoming really heteronymous, or in the least approaching each other. Rivalry often takes place between the two positions, so that the images of the needle will alternately seem nearer and farther than the central circle at the point of convergence.

A beautiful way of testing the same result is to place the knife-point or needle upon the sheet of paper, and coinciding with any point in the circumference, but always allowing the length of the object to lie in, or parallel to, the vertical meridian. If the attention is fixed strongly upon the knife-blade or needle while convergence combines the two circles, the two images of the needle or blade seem to coincide with two of the circles, the central and combined circle, and one of the outer circles. But the central and combined circle seems in the same plane with the sheet of paper and the other two circles. This may vary, however, with rivalry, as experience will show. But if now we begin to move the object toward the eyes, and therefore toward the point of convergence, without altering the latter, and without changing the attention, the two images of the needle or knife-blade will appear nearer than the central circle, and also seem to approach the eyes until they reach a certain point, where they instantaneously assume the homonymous position beyond the central circle. The feeling of surprise is very marked at this sudden appearance of the images at a greater distance than they had just seemed.

If, again, we draw the circles upon a plate of glass in order to combine them by fixating beyond it, and try the experiment as we have described it, the images at first appearing beyond the central circle and homonymous, by close attention will suddenly appear in the heteronymous position, nearer than the central circle, as before. It must be remembered, however, in both cases, that the images do not become really heteronymous, as can be proved by suddenly closing and opening one of the eyes. The same image vanishes in both apparent positions of the double images. The single interesting fact, both when we combine by convergence and when we combine by fixating beyond, is that the two images of the object really beyond the point of fixation will appear at times to be nearer, and will not assume a fixed homonymous position until the attention upon them is relaxed. Now for the explanation.

It is clear that the double images of the needle or knife-blade are simply the ordinary homonymous images, and hence are localized beyond the horopter, or point of fixation. So far the phenomenon only accords with the ordinary law. The anomaly appears when their relative position is changed and they seem translocated into the heteronymous position. But if we revert to the influence of attention in all sensory processes, we may discover a cause for the effect we have described. It is known that we may so absorb our attention as to be unconscious of a severe pain in the tactual sense. Or in vision we may be so occupied with a particular object as not to notice the presence or approach of another. We may even lose entire sight of all objects except the one in which we are interested. Again, it is a universal fact that attention directed to any object in the field of view, at once and automatically sets the eyes into the proper movement for adjustment to produce single vision. At the same time the visual tension of the eyes is relaxed for the object from which the attention is turned. With these simple facts, we may turn to the experiments we have described. Here, when we keep the adjustment for combination constant, but direct the attention to the two homonymous images, the tension for binocular localization is relaxed by the change, and we are left to monocular principles for the localization of the images of the needle as well as that of the central and combined circle. The latter appears in the same plane as the sheet of paper, or approximates it in proportion to the relaxation of binocular tension, and thus introduces monocular influences into the localization of combined images, while only monocular functions are left to localize the homonymous images of the needle or knife-blade. Hence it appears as it really is; namely, nearer than the central circle. We may test whether it is due to the prevalence of monocular over binocular innervation by moving the needle far enough off to make its images coincide, or nearly coincide, with the circumference of the combined circle at the termini of the diameter, and, while they seem in the heteronymous position, suddenly close and open one of the eyes. We shall see the remaining image of the needle apparently nearer than the circle, and in the same position, without change, which it occupied before closing the other eye. The eye must be closed and opened as quickly as possible, so that the other eye will not have time to resume the parallel position, and hence there will be no apparent motion of the circles. This will enable us to determine more accurately the monocular character of the localization of the homonymous images. We see the image of the needle and the circle in the same relative positions as before closing the eye; and, since this can be only monocular, we can best suppose that the translocation we have described is due to the prevalence of monocular functions over the binocular by the withdrawal of attention from the latter.

It is a still more interesting fact that the writer has been able, by considerable practice, to localize one of the images of the needle homonymously under the circumstances described, and the other heteronymously. I have been able to alternate them to some ex-

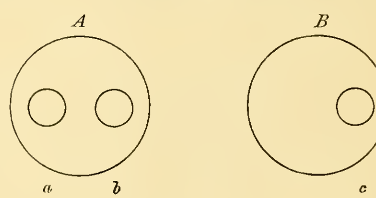


FIG. 2.

tent, although generally it is the left image that appears nearer, and the right image farther, than the point of binocular fixation. In such cases evidently one eye can keep up the binocular innervation, while the other becomes monocular in it. Astonishing and presumptuous as such a supposition may seem, it is entirely confirmed by the following second experiment, which also illustrates the rivalry between binocular and monocular functions, as in Fig. 1. Take the circles A and B, with the smaller circles a, b, and c, as we have drawn them, and combine them by convergence. It is plain that the fusion of b and c will take place at the same time with that of A and B. But a has no corresponding circle in B with which to fuse. If b were absent, the binocular effort at convergence would automatically tend to combine a and c, so that they would appear nearer than the fused image of A and B in the precise ratio of the convergence required for their combination. We have elsewhere worked out the explanation of all such localization in accordance with the reflex innervation, if we may call it such, for adjustment. But we shall not enter upon this in our present problem. We have mainly to notice that a and c will not fuse while the latter, c, can fuse with b. Now, as no greater degree of convergence is required for the combination of b and c than for A and B, their combined image will appear in the same plane as that of A and B. This is of course relatively a monocular localization. But, singularly enough, there is a binocular effort, as it were, in one eye, to combine a with c; and the result is that a appears nearer the observer than the combined image of A and B, without in the least translocating the fused image of b and c from their position in the plane of A and B, and without separating them to produce any fusion of a and c, although the latter can be effected if we will. Rivalry will at times suppress the translocated image of a, so that it appears monocularly located in the same plane with b and c, or A and B. The alternations may be very distinctly observed. But here we have a very evident case of binocular innervation in one eye, and localization of a in accordance with it nearer the observer; while no such binocular translocation and innervation take place for the fused image of b and c, because it preserves a constant relation to that of A and B. b and c sustain the same relations of distance to the median plane, and hence will be monocularly localized in the same position of the third dimension as A and B, although binocularly combined. Whatever of tension or innervation there may be in the left eye for binocular combination of c with a is counteracted by the opposite tension to retain the fusion of b and c, which remains located in the plane of A and B, or, better, of their fused image. Thus there is left only the binocular innervation of the right eye to translocate the image of a to a position nearer the observer than the other images, except when this tension is suppressed by rivalry. Then a is located at the same distance as the others. The incident is interesting as showing that there may be rivalry between binocular and monocular functions for localization in the *third* dimension as well as the ordinary rivalry between colors in plane dimension. It confirms also the results of the first experiment we have described.

We have presented these phenomena to suggest the possibility that monocular influences, apparent in the instances noted, may account for many irregularities and illusions in binocular vision as practised by the experimenter to investigate localization. Why may not rivalry between them suppress certain impressions, so that the effect may appear to be different from what it really is? Why may it not account for the failure of stereoscopic combination of two real objects to translocate their fused image to the point of fixation? We do not insist that our explanation must be correct: nor will too great stress be laid upon our conjectures without some verification from the experience of others. To our experience there seems no other way of looking at the matter.

J. H. HYSLOP.

Baltimore, Md., Jan. 31.

Transcontinental Railroads.

IN treating the subject of transcontinental railways, *Science* (x. No. 241) uses language to the effect that the Cascade Range of Oregon and Washington is known to be a continuation of the Sierra Nevada, and mentioning as a striking and all-important structural difference that the Cascades are volcanic, while the Sierra is granitic, therein assuming as facts two propositions which have been much debated, but which, in the present state of geological knowledge, can hardly be demonstrated. In order to learn the progress of opinion respecting the connection of the two ranges, readers of *Science* should consult the *American Journal of Sciences*, third series, vol. vii. p. 177, wherein Prof. Joseph LeConte suggests the idea, original with himself I believe, of the unity of the two ranges in age and cause.

Second, Clarence King, in 'Geology of the 40th Parallel,' pp. 441–454, extending theory far beyond the support of adequate observation, held that the Cascades were separated in age from the older Sierra by a vast time-interval (to wit, the whole of the cretaceous period), and that the Blue Mountains of eastern Oregon were the real continuation of the Sierra.

Third, Dr. Becker of the United States Geological Survey, basing his opinion on the finding of granitic and metamorphic rocks in the cañon of the Umpqua River in the southern Cascades, remarks (see Bulletin 19, United States Geological Survey) that that portion of the range has a foundation similar to the California ranges, and is probably due to the same upheaval. He thus maintains a proper reserve as to the general question.

Lastly, Mr. Diller (Bulletin 33, United States Geological Survey), after examining the stratigraphical relations of the Cascades, Sierra, and Coast Range at their presumed point of divergence in northern California, while quoting Dr. Becker's discovery and opinion, sums up his own conclusions thus: "As far as is definitely known, the Cascade Range was not represented by a ridge of older metamorphic rocks which were folded and upheaved at the same time with the Sierra and the older portion of the Coast Range, and *is entirely distinct from them in structure and origin.*" In another connection he says, "Such rocks [granitic and metamorphic] make up the Coast Range west of Mount Shasta, and it may be that they form an elevated foundation for the Cascades between Rogue River and Mount Hood; but this is rendered less probable by the complete section along the Columbia River, where the range is cut across nearly to sea-level, showing, according to Professor LeConte, that it is made up almost wholly of recent lavas resting on undisturbed miocene strata." Mr. Diller, of his own observation, announces that the Cascades, where intersected by the Klamath River, are also composed exclusively of recent eruptive rocks. Thus the matter stands to-day, and it is doubtful if the question of a simultaneous origin is to be settled on other than paleontological grounds, by a careful and minute comparison of fossil evidences.

The second assumption, that the two ranges differ in the one being granitic, the other volcanic, I dare say, is but the reflection of the common belief which took its rise from the circumstance of the only known or visited section, that of the Columbia gorge, being entirely volcanic, but is nevertheless a most indiscriminating and erroneous opinion, as I will endeavor to show.

I find that the drift brought down by the ancient glaciers of the Cascades, and deposited in the valleys below, invariably contains a proportion, though very variable, of granitic and sedimentary bowlders. In some cases, particularly of certain ice-streams which flowed into the Willamette valley (which, by the way, is covered for the most part with glacial *débris* to a great depth), the granite and metamorphic bowlders and gravel predominate immensely; sometimes, indeed, to the exclusion of volcanic sorts. The prevailing types in most other drift localities, however, are volcanic. The significance is that a part of the rock-masses eroded by the ancient glaciers were granitic and metamorphic beyond a doubt; and, in the cases where transported bowlders prevail, the parent granitic and metamorphic rock-masses from which they were derived must have preponderated over the volcanic masses. I leave the question of the comparative erodibility of the various rock-masses, as well as the considerations arising from their relative positions, all of which must have had influence on the proportions of granitic, metamorphic, and volcanic glaciated bowlders.

But we need not depend upon the accidental evidences of extinct glacial action to prove the composition of the Cascades, for examinations of the range at different points have shown me that it is not exclusively volcanic by any means; indeed, I doubt much if the granitic and metamorphic rocks do not preponderate over the volcanic rocks, viewing the range as a whole. Judging by the evidence of formations *in situ*, I should say, notwithstanding the existence of exclusively volcanic sections, that the foundation of the range in general is not unlike that of the Sierra, excepting that I see no indication of the great orographic blocks which, according to Mr. Diller, compose the northern Sierra.

Judging from what has been published concerning the range, the prevailing idea of its structure seems to regard it as composed of a single anticlinal ridge composed wholly of basalt, and crowned with snow-covered conical peaks set at regular distances along the range. Geologists who have this idea will be surprised to learn that granite appears in the range at an altitude of two thousand feet, within eight miles of the Columbia. This is on the north side of the river; while on the south, towards Mount Hood, it is said to be found at five thousand feet. I cite only the former instance as observed by myself. I also find granite on the Santiam River at a height of five thousand feet above sea-level, and on the McKenzie at twenty-five hundred, it forming the bed of the latter stream for twenty miles.

One of the most interesting portions of the Cascade Range is the region of the Santiam River, in latitude 44° 45′ north, — a tributary of the Willamette. The lower foot-hills there are composed of a yellowish volcanic ash, stratified in part, and which reaches a thickness of several hundred feet. Such deposits are very abundant on the western slope of the range, amply fulfilling Mr. King's acute prediction of their existence (see 'Survey of the 40th Parallel,' vol. i. p. 453). The ash rests upon basalt, which lies in thick layers conforming to the general westward slope of the range. As we advance into the mountains, the basalt thins out, and at a moderate elevation disappears entirely in its general form of surface outflows, and is seen only as scattered dikes penetrating older rocks. Undoubtedly the basalt rests, as a rule, upon the unaltered sedimentary rocks to be referred to in another connection; but I have not observed them at the precise locality of which I speak. At an altitude of perhaps one thousand feet, the later rocks are replaced in the bed of the stream by metamorphic rocks of a slaty texture, which appear to dip westward. Proceeding up stream, and approaching the axis of the range, we find in very deep cañons some excellent exposures which illustrate the geological structure in a most remarkable and cogent way. The cañons are clearly of glacial origin, and are cut down three thousand feet or more through rocks of various ages, the lowest ones visible being metamorphic slates similar in all respects to the auriferous slates of California, — a resemblance that is heightened by the fact that the Santiam slates are also auriferous, workable quartz veins existing therein. The slates are nearly vertical, with a slight westerly dip. Upon them rest unconformably a great thickness of clayey and sandy shales, and conglomerates, unaltered, and of course devoid of quartz veins, and occupying a nearly horizontal position in general. They are cut by deep cañons into great mountain-masses, and form probably the most important division of rocks at this part of the range. I should judge them to be fully two thousand feet thick, and perhaps three thousand. I have secured no fossils from which their age might be determined, but for statigraphical reasons, with which I will not trouble *Science*, I shall denote the terrane as cretaceous until its age be more satisfactorily determined. I am not aware of any description of this formation having ever been published, nor have I ever heard or read aught concerning it.

Of later sedimentary rocks, the only existing ones yet discovered are certain fossiliferous sandstones and associated shell limestones, which have been spoken of as miocene, and may well belong to that system. They appear in the Cascades as fossil sea-beaches, defining the limits of the miocene ocean. The maximum height at which I have noticed these rocks in the Santiam region is between eight hundred and a thousand feet.

As might be supposed, the metamorphic slates rest against granite, which here forms the backbone of the range, the upper central portions being entirely composed of it and slate, plus a proportion of recent lava, which seems to have come from crater eruptions, but of which I can say little. I desire to call attention to the prevalence of ancient lavas in contradistinction to the more modern basaltic flows. There are heavy bodies of probably augitic lava overlaid by and therefore older than the rocks I have denominated cretaceous. Other instances seem to prove associated lavas as old as the auriferous slates. Of these eruptive rocks, I recognize two or three general types, which I have forwarded for study and determination to Professor Jackson, the petrologist at Berkeley, Cal. Altogether, I believe that the eruptives, old and new, make up perhaps one-eighth or one-tenth of the bulk of the visible terranes of the Santiam.

It is evident that the Santiam section resembles neither the exclusively volcanic exposures cited, nor the Umpqua section, as described by Dr. Becker, who found granite and metamorphic rocks overlaid unconformably by miocene strata, without the presence of intermediate unaltered rocks. Besides, his metamorphic types were chiefly serpentine, which, notwithstanding its immense development in southern Oregon, I have not noticed north of the Calapooia Mountains. It seems not improbable that the serpentines may be the representatives of the unaltered shales and conglomerates of the Santiam.

From the above observations, and from other reasons which I will not take space to explain, I conjecture that the earliest mountain-making movement which affected the Cascades took place much farther back than the cretaceous, as held by some, and resulted in forcing up the granite nucleus, with its covering of slate or the representatives of slate, to a considerable height above sea-level; this movement being followed by extensive denudation, of which good evidence appears to exist. Then followed a submergence, total or partial, when the strata that I call cretaceous were laid down. The whole range could hardly have been ingulfed at the time, for I am told of tracts now existing where no intermediate strata are found between the early granite and the late basalt. I can suggest nothing as to the condition of affairs during the eocene time, the question of the existence of marine strata of that age in Oregon not having received attention.

It would seem that the miocene strata were deposited on rising areas, when the Cascades had reached to within a few hundred feet of their present height.

It is probable that there have been at least two upheavals, and one movement of subsidence, which, with attendant phenomena, I have grouped as follows: —

1. In paleozoic or early mesozoic time, primary elevation of granite axis with overlying sediments, accompanied by metamorphism of the latter.

1*a*. Denudation of range.

2. Subsidence beneath cretaceous sea, and deposition of cretaceous strata.

3. Elevation to within one thousand feet of present state.

3*a*. Deposition of miocene rocks.

3*b*. Outpouring of lavas through fissures.

3*c*. Era of crater eruptions, and deposition of beds of volcanic tuffs in late seas and lakes.

3*d*. Continued elevation of land to present height, accompanied by glacial and aqueous erosion. Diminished volcanic activity.

There are certain evidences, among them Captain Dutton's discovery of a rising surface at the Cascades of the Columbia, which make it probable that the mountain-making movements are still going on in the range.

HERBERT LANG.

Portland, Ore., Jan. 31.

Queries.

27. WASHINGTON'S LETTERS. — In the last number of the *Magazine of American History* there are two letters of Washington which I think are of doubtful authenticity. The first letter is printed on p. 162: the second immediately follows it. Both are claimed to be taken from originals in the collection of Dr. Thomas Addis Emmet. That forgeries are extant of Washington's letters, is well known to collectors. One prominent test of such forgeries is said to be in the autograph. Washington always abbreviated 'George' by writing 'G°,' and never used the initial *G* alone. Such a test, if reliable, applied to the letters, would prove them to be forgeries. This test will hold good in comparing the undoubtedly genuine letters copied from originals in the British Museum, and printed in the same number of the magazine. Again, the subject-matter of these letters is suspicious, especially where Washington is made to write of his troops at Cambridge, that they "are an *exceedingly dirty and nasty people*." I do not claim to be an expert on such matters. On the contrary, my disbelief in their authenticity is based more upon my wish that our beloved Washington did not write such a sentiment.

GEORGE GLENN WOOD, M.D.

Muncy, Penn., Feb. 7.

Answers.

23. DROPS OF WATER. — In answer to Mr. E. J. Pond's query in relation to floating drops of water upon the general surface (*Science*, xi. p. 38), I beg leave to refer him to the paper of Prof. Osborne Reynolds of Manchester (England), published in *Nature*, vol. xxv. p. 23, Nov. 3, 1881, where he will find an explanation of this capillary-film phenomenon, as well as a clear indication of the physical conditions necessary for its production.

JOHN LE CONTE.

Berkeley, Cal., Jan. 30.

BOOK-NOTES.

—'Harvard Reminiscences' is the forthcoming book by the Rev. Dr. A. P. Peabody, preacher to the university, and one of the best-beloved and venerated men in America. For a quarter of a century he has been a high officer in the college; and it is two-thirds of a century since he first became connected with Harvard, — first as student, and then as tutor. The book includes bright little monographs on scores of the college officers of the last half-century or more, such men as Felton, Palfrey, Kirkland, Clarke, Hedge, and Norton, besides many less well known. It is rich in characterization and anecdote and reminiscence, and will be treasured by all Harvard men, students or graduates. The frontispiece is a portrait of the gentle scholar, Dr. Peabody. The book will be brought out by Ticknor & Co. in February.

—Mr. David A. Wells, we understand, devotes the ninth article of his valuable series on economic disturbances to a discussion of the labor-question. It will appear in *The Popular Science Monthly* for March, and promises to be the most important contribution that has lately been made to a problem which is now facing the industrial interests of the world.

— Franklin Leonard Pope, an authority in electrical affairs, will contribute to the March number of *Scribner's Magazine* a paper on the electric motor and its applications, which is a complete account, in brief compass, of the origin and development of the use of electricity as a motive power. It will be fully illustrated.

— Mr. Charles Mackay, LL.D., is about to publish his 'Dictionary of Lowland Scotch,' upon which he has been engaged for several years. It gives the more important words, with their meanings and etymological derivations, together with an introduction dealing with the historical and literary development of the language, and an appendix of Scottish proverbs.

— Forty-two years ago the old *Horticulturist*, under Andrew Jackson Downing, signalled the birth of American horticulture. Later that magazine was united with the *Gardener's Monthly*, which, under Thomas Meehan, has for thirty years been the leading exponent of gardening and rural improvement on this continent. On Jan. 11 the *Gardener's Monthly and Horticulturist* of Philadelphia, incident to the death of its publisher, Mr. Charles H. Marot, was sold to, and will at once be consolidated with, *The American Garden* of New York. The result will be an enlarged, handsome quarto, illustrated monthly journal of gardening, within the reach of all lovers of nature.

— An influential newspaper says that "the approaching suspension of Harper's Franklin-Square Library indicates the close of a regrettable period of American book-making. On the other hand, the long-continued success of Ticknor's Paper Series of original copyright American stories, proves the sagacity of the scheme for providing the best literature in legible and dignified shape, and at a price within the reach of all readers." The continued success of Ticknor's Paper Series of original copyright novels will doubtless be still further assured by the volumes to be added thereto during the month of January, which include 'Beatrix Randolph,' by Julian Hawthorne, and 'A Fearful Responsibility,' by William D. Howells.

Publications received at Editor's Office, Jan. 23-28.

BAIRD, Spencer F., Report of, for the Year 1886-87. Washington, Government. 27 p. 8°.
BALLOU, M. M. Under the Southern Cross; or, Travels in Australia, Tasmania, New Zealand, Samoa, and other Pacific Islands. Boston, Ticknor. 405 p. 12°. $1.50.
BANNATYNE, D. J. Handbook of Republican Institutions in the United States of America. New York, Scribner & Welford. 624 p. 16°.
BRAUN, M. Das zootomische Practicum. Eine Anleitung zur Ausführung zoologischer Untersuchungen. Stuttgart, Enke. 248 p. 8°. (New York, Stechert, $2 60.)
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Feb. 8.—Artemas Martin, On Square Numbers whose Sum is a Square; R. S. Woodward, On the Variation of Terrestrial Density, Gravity, and Pressure according to the Laplacian Law.

Purdue Scientific Society, Lafayette, Ind.

Jan. 23.—J. H. Smart, Topography of Holland; A. L. Green, Chocolate, Cocaine, and Cocoanut.

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SCIENCE

FRIDAY, FEBRUARY 17, 1888.

FOR MONTHS PAST the attention of university men throughout the country has been centred in the Princeton College Board of Trustees, who were deliberating as to the successor of Dr. M'Cosh in the presidency of that institution. On Thursday, Feb. 9, the fruit of those deliberations was seen in the unanimous election of Francis L. Patton, D.D., to the vacant post. This choice is on all grounds to be warmly commended. Dr. Patton is still a young man, being but forty-five years of age, and has yet to put forth to their fullest extent his marvellous intellectual powers. We seriously question whether any college has a president of so high an intellectual stamp as Dr. Patton. His theological and philosophical learning is vast in extent, and rich in quality. Both with tongue and pen he is clear and incisive. His critical ability is unrivalled, and in his new position he will have ample opportunity to show whether or not he is equally strong in constructive and administrative power. To follow Dr. M'Cosh is a trying test for any one, but we feel sure that Dr. Patton will confer honor and credit both upon Princeton and upon himself in his administration. That it may be long and prosperous, and that Dr. M'Cosh may long be spared to witness the carrying-on of the work that he has so wisely planned, is the hearty wish of every friend of higher education in this country.

SCIENCE IN ELEMENTARY SCHOOLS.

IN the report of the council of education (England and Wales) for 1887, there are some excellent remarks about elementary science-teaching which are reproduced in a recent number of *Nature*. The judgment is passed that nothing could be more unsatisfactory than the present position of the knowledge and teaching of science in the elementary schools. Notwithstanding all the advantages that have been offered pupil-teachers for the study of science, as a body they appear to be in a most deplorable state in this respect. The inspector who reports on training-colleges finds the ordinary pupil-teacher deficient even in mathematics. It is in doubt whether this deficiency should be ascribed to poor teaching or defective early training. Mr. Fitch, who reports on female training-colleges, finds things no better there. At the admission examination the work in the arithmetic is satisfactory in point of accuracy, but it displays want of method, failure to appreciate the meaning of the question asked, and ignorance of principles. Thus very few of the candidates were able to give an intelligent explanation of simple arithmetical processes, such as subtraction or division. With them, as with the male pupil-teachers, book-work and memory are wholly relied on, and little attention is paid to the intelligent application of principles. "Scarcely three per cent are able to do much more in the teaching of arithmetic than work sums more or less correctly on the blackboard."

With such material to work on, it is not surprising that the results of the work at the colleges are not what they otherwise might be. Those who are below the average at admission rarely succeed very well in the array of subjects to be learned in two years' training. With regard to the male students, the reports at the close of the first year's training record that the answering of the questions set on the first book of Euclid was disappointing. The students appear to have learned their propositions by rote, and to have displayed great want of neatness and accuracy. Though the riders were joined to the propositions on which their solution depended and though all these riders were easy, very few of the papers were satisfactory. This inability to solve the easiest geometrical deductions is commented on again and again, and proves beyond doubt that either the students are negligently taught, or that they commit the book-work to memory without understanding it, and consequently are quite incapable of applying their knowledge to solve the simplest riders.

In summing up his impressions of the male training-colleges, the inspector gives it as his opinion that the students are over-lectured at some of the colleges, and that the lectures are mechanically reproduced, and transferred as closely as possible to the examination papers. This, of course, is due to the defective early training of the students, and to lectures injudiciously delivered on subjects about which students know absolutely nothing. For instance: one lecturer delivered a very excellent discourse on the corrupt form of Latin used by the Roman soldiers in Britain, its causes and its effects, to a class of which few, if any, of the members knew any thing whatever of Latin.

In the female colleges, even in arithmetic, questions on theory and principles are not well done, long problems are inaccurately done, and, as a whole, it is seen that there is yet much that remains before it can be said that the present system is satisfactory as regards the knowledge given and the methods adopted. There appears to be among the students a very narrow view of their future work, a desire to regard the obtaining of their certificates as the goal and aim of their existence. The views on science, of one of these maidens, are worth recording: "If I am successful in obtaining my certificate, I intend (D.V.) going in for two sciences. At the same time I propose attending a tonic-sol-fa class to get my advanced certificate. Should the two sciences 'sound, light, and heat,' and 'electricity and magnetism,' prove a success, I shall probably take up the science of hygiene." If the training-colleges tend to remove the impression that the technical qualification is the end of the pupil-teacher's work, if they awaken a spirit of emulation among the students, and enable them to teach more thoroughly and intelligently, then they will have fulfilled a large portion of their duties.

With such products as are thus indicated, as teachers, it is easy to predict what the schools that are under their care will be like. With masters, the majority of whom know little or nothing of even the elements of science, the pupils cannot be expected to pass well in these subjects. Thus it is seen, in the return of the number of pupils sent up on 'specific subjects' (most of which are scientific), that only 16.51 of those eligible for examination have been so examined, and of these nearly one-half were from the London School Board District. One-half of the passes were in algebra and animal physiology.

The inspectors in all parts of the Kingdom agree, that, with the exception of some of the cities and large towns, throughout the elementary schools science is untaught. This we can well imagine, when we have seen that the average teacher is completely ignorant of any of its branches, and it is the average teacher who is sent to the country schools. The explanation of some of the inspectors, that in the country for a great portion of the year the attendance of the children who are fit to be taught these subjects is very irregular, does not meet the question; for, even were the children most regular in their attendance, the subjects could not at present be taught, and, until the average elementary teacher is altered, they will not be taught.

The brightest spot of all appears to be Nottingham, and there 2,526 children were examined in specific subjects, of whom four-fifths passed. "Mechanics for boys, and domestic economy for girls, are the subjects principally taken by the Nottingham Board Schools, and are taught by a specially qualified science demonstrator and assistant, who visit the various schools in turns, bringing the apparatus with them in a specially constructed hand-cart. The lectures given on these occasions are afterwards gone through again by the teachers of the schools, from notes taken at the time. These lectures are simple and interesting, and are given with great care and skill. The results are remarkably good, both as regards the actual knowledge acquired by the scholars, and the stimulus given to the general intelligence. Besides the above-named subjects, physiology and algebra are often taken with very good results, and in one school the principles of agriculture are taught with marked success."

Some of the causes of this almost total absence of any scientific teaching in the elementary schools have been pointed out. Where science has been well taught, it has borne good fruit; and where teachers and managers have set themselves steadfastly to overcome the difficulties in their way, a high and encouraging measure of success has been obtained. Thus we have the remarkable testimony of the success of the experiment in Nottingham, and surely there are many other districts in England quite as competent to carry on this work as Nottingham. Why it could not be done in any town in England, it is difficult to see. In many cases where these subjects have been taught, the inspectors have wisely set their faces against them, finding but a wretched smattering among the pupils. Nothing else can be expected in remote rural districts, where the teacher, whose whole time is scarcely sufficient for the few rudimentary subjects, is so ambitious as to attempt to cram some of his pupils with the elementary knowledge of a science of which he is himself confessedly ignorant. But in the towns and cities competent teachers are always to be had. If the board masters do not find themselves fit for the extra labor and extra knowledge required, there should be no difficulty in obtaining a specialist, as has been done at Nottingham. And in no place could the foundations of technical education be more surely laid than among the elder children of elementary schools. In the minutes and instructions issued to her Majesty's inspectors, managers are requested to aid, in every way they can, the teaching of one or more specific subjects appropriate to the industrial or other needs of the locality, and the rudiments of two higher subjects to supply a foundation for future work. With this object, it is suggested that where the teacher is not competent to do so, — and this, according to the reports, is the rule, and not the exception, — a specialist might be employed by a number of schools in a district, whose instruction would be supplemented by that of the ordinary teachers. There is only one instance, that of Nottingham, given in the reports, of such suggestions having been followed.

What is said in the report about geography and geography-teaching is of special interest. It appears that while there is a great absence of culture and general intelligence upon the part of a considerable number of candidates, yet the answers to the geography-papers set for admission to the male training-colleges are more accurate than would be supposed.

Here, again, the metropolitan candidates are superior to the provincial candidates, particularly in the map-drawing, though in this particular there has been a falling-away of late. Among the female candidates, the geography was not very satisfactory, exhibiting inaccuracies in map-drawing, indefiniteness in the answers, and generally marks of defective early training. In the examinations for the first year's certificates the male candidates answered fully and accurately; but usually there was a slavish following of the words of the text-books and the lecturers' notes. At the end of the second year there is the same report, — book-knowledge without intelligence, and abundance of information imperfectly digested. With the females the result is the same, — verbatim reproduction of the books or notes they had read; fairly creditable answering; but "the style of the papers reveals the painful poverty of the general reading of the students, and the utter absence of any individuality, or attempt at description in their own words." In many papers there was a constant iteration of the same words and phrases, suggesting that the candidates had learned off by rote the answers to probable questions. With regard to the elementary schools, all the reports agree in saying that there has been a marked improvement in the teaching of geography. Where it is intelligently taught, it is the favorite subject; but too frequently the children are not well grounded. While all parts of the country report progress in geography, it is worthy of remark that all the maritime districts surpass the inland schools in the knowledge of the country, its colonies, and its trade. The report believes that this is only natural, and insists that "the teacher who would not, in Devonshire, interest a class of boys in the voyages of Drake, or who, in Somerset, would not rivet the attention of his pupils on the victories of Blake, would not be worthy of his post." Though the teachers may be congratulated, speaking generally, on the progress made in geography, there are many faults to be found. In portions of Wales and of the centre of England, geography is only fairly satisfactory. The pupils are weak in questions of latitude and longitude: they do not learn intelligently, because most probably they are taught mechanically and unintelligently. It should be within the power of every teacher, by the use of an ordinary globe, to make this portion of the subject intelligible to any ordinary boy. But few lads could understand a lesson on meridians and parallels, given by a teacher who does not use a globe at all; and yet this is quite common. Hence it is that the map-drawing is very poor, even where there is a good knowledge of geographical facts. Many of the inspectors complain of lack of globes, maps, etc.; and, even where there is abundance of general maps, there are no local maps, — a want which is very widely felt. In this respect the Board of Education might take a lesson from the commissioners of national education in Ireland, who have published local maps, and require each pupil in the higher grades to know, in addition to general geography, the map of his neighborhood.

THE IMPROVEMENT OF HARBOR ENTRANCES.

IN 1743, under the direction of Dr. Benjamin Franklin, a movement was started in Philadelphia for the organization of the first scientific society in America; and in a letter from Franklin, under date April 5, 1744, to his friend "Hon^e Cadwallader Colden, Esq.," he says, "The Society, as far as relates to Philadelphia, is actually formed, and has had several Meetings to mutual Satisfaction; — as soon as I get home, I shall send you a short Acct. of what has been done and proposed at these meetings."

This society, which for nearly a century and a half has been known as the 'American Philosophical Society for the Promotion of Useful Knowledge,' has been presided over by the most distinguished of American scientists and scholars, and an election to its membership has been an honor cherished no less by foreigners than by Americans. The society to-day is venerated for its age, distinguished for its services in promoting useful knowledge throughout the continent, and claims for its supporters the greatest scientists, the most cultured scholars, and the most prominent of American engineers who have been active in the dissemination of useful knowledge through improved navigation, the creation of canal and railway systems, the telegraph, and the development of the mechanic arts, by which useful knowledge has become as free to all as the air we breathe.

In 1785 John Hyacinth de Magellan of London, recognizing the prominent position of the society, proposed to donate to the society "200 guineas, to be appropriated as a perpetual Fund; the interest of which to be annually given, in a medal of gold, as a Premium to the author of the best Discovery, or most useful Improvements relating to Navigation or Natural Philosophy." The conditions under which this premium was to be awarded were drafted by a committee of which Dr. Franklin was a member, and were approved by Magellan himself. These conditions are so exacting that but few discoveries have been considered sufficiently important in themselves to merit the high honor of the 'Magellanic Medal,' — an American honor which is esteemed more highly than any to be won by a scientific discoverer in the field of navigation, natural philosophy, or astronomy; which latter subject Magellan subsequently included. It has now been many years since any discoverer has received this medal, although applications are continually presented which seek the prize so zealously guarded by the society.

Last spring a paper was presented to the society, describing a most important discovery in ocean dynamics, under the title 'The Physical Phenomena of Harbor Entrances, their Causes and Remedies. — Defects of Present Methods of Improvements.' This, with other communications, was referred to the consideration of the twelve counsellors and other officers of the society, and on Dec. 16 a favorable report on the discovery was made to the society, and, by a secret ballot of the members, the premium was awarded the same. Upon opening the sealed letter with the same motto as that accompanying the description of the discovery, it was found that the premium had been awarded Lewis M. Haupt, professor of civil engineering at the University of Pennsylvania. This discovery of authorship was a surprise to the society, since it was thought that the author of the paper would have proved to be a member of the Coast and Geodetic Survey, of the Hydrographic Office, or of the River and Harbor Improvement Service, a number of the members of which have given much attention to the laws of ocean dynamics in determining the improvements to be made annually by the government to our rivers and harbors. The mere announcement, however, of Professor Haupt's name was confirmatory evidence of the wisdom of the society in awarding the medal. Professor Haupt, although an engineer graduate of West Point, has, during the past twenty years of civil professional life as an engineer, won such success and distinction in his profession, that the present honor which he has received only re-enforces the views which are gaining such a stronghold, — that the civilian engineer merits a standing in all government engineering work on the same basis as the regularly commissioned officers.

Tersely, the object of the paper presented to the society was to collate certain observed facts for the purpose of explaining the physical phenomena of harbor entrances, and of deducing therefrom conclusions of practical value in the economical solution of the problem of improving the channels and shelterings of harbors.

What was claimed in the paper as meriting the favorable judgment of the society is briefly outlined by the author as follows: —

"1. The determination of the character, direction, and relative intensities of the forces acting upon any harbor entrance, from a study of the submerged topography and other local physical features.

"2. The discovery of the existence of typical form, in the sandy spits bordering the entrance, which will in general indicate the direction of the resultant movement.

"3. The recognition of the fact that the proper place for the ebb discharge, or channel over the bar, is as far removed as may be from the point of direct attack of the flood resultant, when the direction of the latter is not normal to the coast.

"4. The definite enunciation of the principle that the trend of the coast with reference to the cotidal line will in general indicate at once the proper position for defensive works.

"5. The presentation of an original form (in plan) of breakwater, whereby the natural agencies are materially aided, without serious interference with either the flood or ebb forces.

"6. A method of improvement whereby the internal currents are concentrated and conserved for more efficient scour after passing the gorge.

"7. A plan for utilizing the natural tendencies of the flood to cut a beach channel which shall be available for the lighter-draught vessels.

"8. The enunciation of the principle that the cause of the angular movement of the ebb stream after egress is due to the general form of the exterior coast-line, which causes a racing of the tidal crests, from the outer capes towards the bight of the bay, and that the flood components thus generated are the forces which build the bars and shift the inlets. This incessant semi-diurnal action of the flood is the controlling element in the forces affecting the magnitude and position of the bar. Storms and winds may modify and shift the deposits, but eventually the flood re-establishes the original conditions.

"9. The free circulation and ingress given to the flood by the detached breakwater, so designed as both to oppose the flood and produce interfering waves which deposit sand outside of the channel, whilst it also aids the ebb in its attack on the bar by defending its channel and concentrating its volume.

"10. For a given site and stage of water, the flood movement approaches in the same direction, hence the resisting and regulating works should be placed on the near side of the proposed channel. If on the far side, they would be worse than useless, unless for shore protection.

"11. No artificial re-opening of an outlet which has been closed by this flood component can be maintained without auxiliary works to deflect and modify its action. Dredging is only justified when the interests of navigation are sufficient to maintain a continuance of the expense, and no other reasonable methods are available.

"12. The ability resulting from these general principles to construct works requiring a lesser linear development which will produce greater navigable depths at less cost.

"13. The abolition of the risks and difficulties attending the navigation of narrow jetty entrances in times of danger.

"14. It frequently happens that the requirements of navigation and tidal concentration are conflicting: the former demanding wide entrances; the latter, on account of insufficient tidal volume, narrow ones. This debars the usual jetties, and prevents improvement. The plans herein proposed are eminently adapted to meet such contingencies."

The last-mentioned condition applies in a significant way to the conditions at Absecon and other inlets.

The phenomena of tidal movements, and their bearing upon the formation and destruction of barriers in harbor basins, are of course influenced not only by the topography of the coast-line, but by that of the bottom of the harbor itself, both of which features are in turn perpetuated or changed in form by the relative resistance of the material forming the bottom of the harbor, and the direction and force of currents due to fresh water and tidal movements, winds, and waves. Yet, at the same time, little has been correctly understood as to the laws governing these movements. The new conditions which Professor Haupt so ably enunciates in his paper throw much light on the study of the history of our offshore waterways, as shown by an inspection of those extending along the Atlantic coast, as exhibited by the Coast Survey charts. This is particularly realized in an examination of our southern bay, extending from Cape Florida to Cape Hatteras, and of our middle bay, from Cape Hatteras to Nantucket. The application by Professor Haupt, of his principles and discovery to local conditions along this coast-line, is unique and forcible. It is certainly evident to an intelligent and experienced engineer, as Professor Haupt himself indicates, that, if it is proposed to aid nature, the engineer "must so design his external works as to prevent the flood-tide from carrying sand into the channel to obstruct the ebb and require more work of it for its removal." His system is based upon an internal concentration of the ebb currents in their path to the gorge, and of their external conservation after passing through this section to the ocean.

A paper narrating a discovery so important in ocean dynamics as this, cannot be fully reviewed or fairly treated in a brief space; but one of the most convincing arguments in support of the conditions enumerated above is the application of the discovery to the cause and direction of the tidal movements in Barnegat Inlet as bearing upon the location of the light-house which was erected in 1834, but which was subsequently destroyed prior to the erection of the second structure in 1858. This latter structure has been ineffectually 'protected' by a system of jetties, and it is now evident, in the light of the investigation of this particular case, that the structure has been improperly placed on the spit opposed to the flood resultant. If the light had been placed on the north spit, the interests of navigation would, no doubt, have been as well protected, and all the defensive works which have been constructed at great cost to the government would have been rendered entirely unnecessary.

Lentz, in his 'Ebb and Flow of Tides,' says, "The intricate, theoretical, tide-generating conditions are complicated by a number of circumstances, forming a bewildering labyrinth of causes and results, through which the human mind cannot find its way." When one bears in mind such a statement from an authority so high, too much cannot be said in praise of Professor Haupt's discovery in its bearing on "useful improvements relating to navigation" as well as "natural philosophy," and of the high honor conferred upon him by the American Philosophical Society in awarding him the Magellanic premium. C. A. A.

EXPLORATION AND TRAVEL.

Notes on the Geography of Labrador.

THE December number of the *Bulletin of the American Geographical Society* contains a paper by A. S. Packard on the physical geography of Labrador. The paper is accompanied by a map of Labrador, compiled by F. Leuthner, and said to show the present state of our knowledge. It is founded on the British

Admiralty maps and a manuscript map by S. Weiz, a Moravian missionary who visited the northern parts of the coast of Labrador. The latter was published in January, 1869, in the *Missionsblatt aus der Brüdergemeinde*, and we reprint it here side by side with the latest British Admiralty map (No. 863, Hudson Bay and Strait) for comparison. It will be seen that the geographical positions, as well as the coast-lines, show many discrepancies; so much mark, "Large corrections: April, 1882, June, 1885," show Greely's discoveries, but not the valuable work done by Danish, American, German, and French explorers. The same is the case in the sheet mentioned above, which was published in 1884. Evidently neither Weiz's nor the British maps are founded on reliable observations. Weiz's route on board the schooner 'Meta' is shown on his map, and it will be seen that he did not visit the deep fiords. The

so, that it is impossible to compile them into one map. The positions of the admiralty map are comparatively correct; but it may be assumed that the outlines of the coast, and the names and positions of the islands, are better on Weiz's map, as he gathered his information from Eskimo who are well acquainted with the coast. Unfortunately the admiralty maps of these regions are not up to date, and are therefore extremely deficient. The maps 'Arctic Sea' (No. 2177), for instance, the eastern sheet of which bears the nomenclature of the British maps is very deficient, the local names of places being misspelled so as to become almost unintelligible. As we find, instead of *T*, *J* in most parts of the coast, I concluded that the original is a manuscript of a German missionary, the *T* in a German handwriting being similar to an English *J*.

Besides the explorations mentioned by Packard, a considerable amount of work has been done in Labrador and the adjacent parts of the country. Lake Mistassini was explored in 1884–85 by an expedition sent out jointly by the Geological Survey of Canada and the commissioner of crown lands of Quebec. The latter has recently sent surveyors who explored the numerous rivers emptying into the St. Lawrence. I mention particularly C. E. Forgues's survey of the rivers St. John, Mingan, Natashquan, and Esquimaux. Last summer the missionary Edmund James Peck succeeded in crossing Labrador from Richmond Bay to Ungava Bay. Green Island, in Hudson Bay, as shown on Packard's map, does not exist according to observations made by Gordon on his expeditions to Hudson Bay. The archives of the Department of Marine of France possess a number of manuscript maps of Hudson Strait, which, however, have not been published.

LABRADOR, FROM THE BRITISH ADMIRALTY MAP NO. 863.

An interesting sketch of the physical geography of Labrador was given by Dr. R. Koch, who wintered in Nain in 1882–83, and visited the stations of the Moravian missionaries. He describes the country in the *Deutsche Geographische Blätter* (vol. vii. No. 2, 1884). The outlying islands are barren and destitute of vegetation; the valleys adjoining the bays and fiords, however, have beautiful forests of pine and larch, surrounding dark, quiet lakes. Towards the mountainous region the woods are lighter, and the numerous dead trunks testify to their struggle against the gales of winter. Travelling by sledge westward from Nain, the plateau of the interior is reached after four or five days' travel, of about thirty miles each, through fiord-like valleys. After one or two days more, the height of the land is reached. The height of the land approaches the shore in the northern parts of the peninsula, being only one day's journey distant from Rama. The narrower the mountainous district becomes, the higher it is. Near Hoffenthal the mountains do not exceed a few hundred feet in height. At Nain the mountains close by the sea are from eight hundred to twelve hundred feet high. The Kiglapait, between Nain and Okak, have an elevation of several thousand feet. North of Hebron the country is alpine in character, the mountains rising almost vertically from the sea. Deep, narrow fiords intersect the coast, which is not sheltered by islands from the heavy swell of the ocean. But, although the peaks attain a great height, no extensive snow-fields and glaciers are found. From Hebron to Komaktorvik there are hardly any islands off the coast, but farther north it is skirted by innumerable dangerous rocks. Near Rama, Koch ascended a mountain twenty-six hundred feet in height. He describes the scene as very grand: "At my feet I saw the deep bluish-green fiord surrounded by steep, wall-like cliffs. The mountains were covered with shrubs colored red by the first frost of the season. To the left spreads the dark blue ocean, with its greenish-white icebergs. On the opposite side of the fiord, and towards the west, extended steep and ragged mountains, and narrow gorge-like valleys, in one of them a dark lake, the water of which, black as ink, reflected the high peaks. In the interior I saw mountains rising to still greater heights, and covered with fresh snow extending north and south as far as I could see. The highest points of this range are opposite the island of Aulatsivik, and reach elevations of from eight thousand to nine thousand feet. While mountains less than fifteen hundred or two thousand feet in height are rounded, and bear evidence of having been covered by glaciers, the ragged forms of the higher mountains show no such signs." Continuing, Koch describes the terraces and lakes formed by the rivers and the old beaches, which he found in several bays as high as one hundred feet above the level of the sea.

Some additional information is contained in the publication of the reports of the German polar stations of the international system. Since Koch's visit to Labrador, meteorological observations are being made at all missionary stations of the Labrador coast, which are of particular value as filling the wide gap between the system of Canada and the Danish stations in Greenland.

PHYSIOLOGICAL AND PATHOLOGICAL REVERSION.

WRITERS on evolution, and especially Darwin, have endeavored to explain many curious facts in the forms, colors, and general appearance of animals by reversion to a condition existing in ancestors more or less remote. As this explanation has seemed to be the only one that met the cases, it has been largely accepted. But, so far as I know, physiological and pathological reversion in the sense in which the terms are used in this paper, has not been employed to any appreciable degree by writers of any class to explain phenomena which seem to me to gather fresh interest around them, and appear in a new light when thus viewed.[1] By physiological reversion I mean a return to a condition functionally similar to, if not identical with, that existing in some lower form; and by pathological reversion, an analogous result dependent on a disordered condition (disease).

It is now almost superfluous to point out that the embryo of the highest mammals passes through stages of development closely allied to the permanent forms of groups of animals lower in the scale. But that there is also a close functional resemblance in many particulars has not been much insisted upon. The subject is so large that the various adaptations in the embryo to an environment that is but temporary can be only indicated, and not treated in detail. It is plain that the embryo of the mammal, being surrounded by a fluid medium and drawing the oxygen supplies for its tissues independently of any actual contact with an atmosphere, must resemble functionally aquatic animals proper in many respects. It breathes by the placenta, virtually as the fish and other aquatic animals by gills. The condition of the blood puts it on a par with lower forms; and, even in the highest intra-uterine stage of develop-

[1] It was not till long after this paper had been written, and a considerable time after it had been read before the Medico-Chirurgical Society of Montreal, that I became aware that the principle involved in the discussion had been previously announced by Dr. Milner Fothergill of London in a communication printed in the *Medical Press and Circular* for August, 1886. I am glad, however, to be able to make this acknowledgment on behalf of so bold and original a writer as Dr. Fothergill.

ment, the blood supplied to the tissues is not completely aerated, — a condition remaining in all forms lower than the birds. Many functions peculiar to the mammal, or, if not actually characteristic, but indifferently developed in lower forms, are still less marked in the mammalian embryo. If there be consciousness, it is of that obscure kind existing only in forms of life low in the scale. Reflexes, indeed, there are in abundance, and probably much nervous automatism; but such limited action of the nervous system is precisely what distinguishes lower from higher groups of animals.

Nor is the adaptation of the newly born mammal to its surroundings immediate. Throughout the first days of the life of the infant, such adaptation is very imperfect, and in consequence many children perish. Further, the resemblance of the infant to animals of lower groups is shown in many directions, and especially in the neuroses and psychoses. The study of infant psychology has of late attracted much attention, and promises most instructive results.

Turning from embryonic and infantile life to the opposite pole of existence, old age, there is much that points in the direction of reversion. It is not a matter of great importance whether we regard this as physiological or pathological. Shakspeare's unrivalled description of the epochs (biological and psychological) of human life will occur to many readers. We must not, however, push the resemblances between the infantile and senile stages too far. There is sometimes a functional likeness which can scarcely be considered genuine physiological reversion, although it is a species of functional reversion, for the consequences are the same. But in general in both conditions there is an imperfect adaptation to the environment. Moreover, in certain respects the old man reverts rather to the functional condition of lower forms of life than directly to a previous stage in his own existence. Thus the imperfect action of the respiratory, circulatory, cutaneous, and also of the nervous system, by which the functions of the cerebrum and the senses are weakened, are all either physiological or pathological reversions, as we choose to regard the matter. But it is not on such facts, however, that I would rely to establish the principles of this paper.

In the various stages of slow or natural death, we have the clearest evidence of physiological reversion in not one but many different systems of the body.

Normally expiration is largely passive, though possibly less so than the text-books of physiology have represented; but, as is well known, in the dying man this phase, and indeed all phases, of the respiratory act are in turn or contemporaneously modified: there may be a diminution of one phase, and an exaggeration of another, etc. In the frog and turtle both inspiration and expiration are active: in such animals we recognize a function, moreover, of the mouth and pharynx, in respiration, normally unknown in man. Dr. Garland has, however, pointed out that in the tracheotomized dog, and, as he believes, in man under the same circumstances, and also in the moribund, a form of the throat respiration supervenes. He has proved this experimentally in the tracheotomized dog (*Journal of Physiology*, vol. ii.). In other words, there is a resemblance to what exists normally in the frog. Garland recognized this, though he has not spoken of it as a physiological reversion. But apart from this minor reversion, it is plain that in general the respiration of the dying bears a resemblance to that of the groups with an active phase in both halves of the act. Further, there is frequently a marked facial and laryngeal respiration, so well seen in the normal breathing of such lower mammals as the rabbit.

Accompanying this alteration in the respiration, there is a great change in the circulation. As I have shown, as the result of a special study of the subject ('The Rhythm and Innervation of the Heart of the Sea-Turtle,' *Journal of Anatomy and Physiology*, vol. xxi.), functional action ceases in the hearts of the cold-blooded animals invariably in a certain order; that is to say, the parts latest developed phylogenetically, as the ventricles, are the first to cease to act. The same applies to the mammal, and I have elsewhere ('A Physiological Basis for an Improved Cardiac Pathology,' *Medical Record*, Oct. 22, 1887) expressed the conviction that it is fortunate for man that such is the case. It is difficult to see how the ventricles could retain at once that sensitiveness and power to adapt to the ceaseless and innumerable changes in the inner life of a mammal, and also the resistance so marked in the auricles and the great veins at their junction with the right auricle, corresponding to the *sinus venosus* of lower forms. Now, in the moribund there may be only an occasional beat of the ventricles to several of the other parts of the heart; or the ventricles may pulsate so feebly as to expel but little blood: hence the latter becomes gradually more venous, with corresponding effects in the venous channels, which become more prominent; in the nutrition, leading to lowered temperature generally most pronounced in the parts most distant from the heart; in gradual loss of all the functions of the cerebrum; finally, the only muscles that are functionally active are the respiratory, the sphincters, etc. In a word, the dying human subject sinks functionally lower and lower in the scale of animal life. There is physiological reversion of the widest kind. This seems the most instructive aspect of the facts; indeed, I can see no other way in which a really philosophical significance can be read into such phenomena.

It may be readily perceived that in sleep itself there is a daily reversion. Sleep not only reduces all human beings to the one level, but it puts all mammals on the one plane. Now, it will be seen, if we consider the nervous system, that the parts peculiar to man, or most developed in man, are the very ones that for the time being are as good as annihilated in sleep. Why should this be so? Why should this order be followed? To say that the parts of the nervous system remaining functionally active are those necessary to maintain the vital functions, in reality throws no light on the question unless we regard man as derived from lower forms, while the whole becomes clear enough if we admit this. Much the same line of argument applies to the reversions witnessed in hypnotism, somnambulism, and allied phenomena.

Hibernation is one of the most interesting examples of physiological reversion to be found. We witness in the bat, though one of the most active of animals, a return during hibernation to a condition very much like that normally present in a cold-blooded animal such as the turtle; while the cold-blooded groups themselves pass into a winter sleep allied to the quiescent state of plants or the 'resting stage' of the infusorians. Reversion alone — physiological reversion — seems to explain such behavior.

These general phenomena prepare us to understand certain results following experiment, which, so far as I know, physiologists have never explained satisfactorily. I shall take my illustration chiefly from cases mentioned in the ordinary text-books, and especially from the magnificent work of Prof. M. Foster, as in that we find subjects usually considered from different points of view.

It has been pointed out that if the nerves supplying the posterior pair of lymph hearts in the frog be divided, though their action ceases for a time, it is eventually resumed; that if the sino-auricular junction of the heart of the turtle be ligatured under favorable circumstances, the action of the auricles and ventricle, temporarily arrested, may be resumed.

In general, if the sinus, or the sinus and auricles, be ligatured off from the ventricle in a frog or turtle, and all the cardiac nerves be divided (precluding the possibility of nervous stimuli reaching them from distinct centres), these parts of the organ, I have observed, will beat more forcibly against the unusual resistance than before.

It is stated, that, when the cervical sympathetic is divided, the dilatation and cessation of rhythmic action of the arteries in the ear of the normal rabbit, ensuing, are finally followed by a return to the normal condition.

The latter has been explained by the assumption of a local nervous mechanism, which, though habitually influenced by the central nervous system, suffices of itself when the connection with the nerve-centres is severed; but such local nerve-mechanism has never been demonstrated anatomically. These and many similar cases are explicable by physiological reversion. In lower forms,[1] in which it is quite impossible to believe in a local nervous mechanism at all, there is pulsation in vessels, etc., owing to the rhythmical action of unstriped muscular fibre or of cardiac muscle. This function of the muscle is no doubt under the control of the nerve-centres in all the higher groups of animals; and when it is exhibited apart from such connection, we naturally seek for an explanation,

[1] This subject is discussed in my paper on the 'Causation of the Heart-Beat,' etc., in the *Canada Medical and Surgical Journal*, January, 1887.

To my mind, the only one adequate is to be sought in physiological reversion. Whether there are not examples of it even when the nervous system is intact, as in excessive action of the bladder, ureter, etc., in cases of obstruction, is worthy of consideration.

Dr. Pye-Smith (*Journal of Physiology*, vol. viii.) has maintained, from certain experiments made by him, that the vessels of the ear of the rabbit, etc., do not regain their tone after section of the nerves concerned, and concludes that nerves are not essential to nutrition. However it may be as to the first proposition, I cannot help thinking that the author's conclusions are broad to the verge of decided error when applied beyond the case in point.

Assuming, however, that in most instances the vessels do not regain tone, I should interpret the case as one of still more remote reversion to a condition when nerves were not required for nutrition, — a condition existing in several large groups of animals. Such a case in the mammal must be very rare, however, and is offset by thousands of facts that show that nutrition is dependent on nervous connection. It would appear that oxygen may be absorbed both from the skin and the alimentary canal; and, if we may judge by many analogous instances, this capacity would be augmented when the individual greatly needed such help, owing to imperfect action of the lungs. In such instances we have, on the one hand, a retained function operating in man to a very minor degree; but, as is now well known, in batrachians the skin is an important respiratory organ, though also one acting very much in a manner supplementary to the lungs, as circumstances necessitate. When in man the skin and alimentary canal function as respiratory organs to an unusual degree, we have physiological or pathological reversion.

It is well known that in certain pathological conditions (hysteria, etc.) large quantities of gas are secreted by the alimentary tract; nor is this so surprising when it is remembered that the digestive canal and the respiratory organs have a common origin from the same cell layers of the embryo.

If our swallowed oxygen can be absorbed by the alimentary canal, of which there is no reasonable doubt, it is plain that we retain a function discharged by an analogous organ, the air-bladder of fishes.[1] Certain groups of turtles (if not all, occasionally, as I believe) have a species of pharyngeal respiration. Oxygen is absorbed from the water gulped into the pharynx, and possibly the case of absorption of gases from the alimentary canal of mammals is still more like this than the analogous instances already mentioned; but, at all events, there is a potential capacity in the alimentary tract of man for respiratory functions which is unquestionably under certain circumstances considerably developed; and the most natural explanation is physiological reversion.

In an allied system, the renal, we have evidences of physiological reversion. In most fevers the skin is less active, and the kidneys function excessively or at least differently; the urine, though scanty in quantity, is of high specific gravity, and thus resembles more the same secretion in not only lower mammals, but the lower divisions of vertebrates. In a whole host of diseases[2] there is a great increase of a constituent which is but scantily present in normal urine, — uric acid. But uric acid replaces urea in fishes, reptiles, and birds; and in not a few cases in man in which the uric acid is increased the urea secretion is diminished. That man's kidneys should thus have the capacity to function in a manner analogous to those of lower forms, calls for explanation. The fact that in such cases the reversion does not wholly cover the functional disturbance arising from or giving rise to this change, is not a serious objection; for it is not to be supposed that an animal adapted to new conditions should, by any reversion to an ancestral state, escape wholly, or even in great part, the penalties of incomplete adaptation.

In the digestive system of man and other mammals we have interesting instances of physiological and pathological reversion. Regurgitation of food is normal in some birds, and I am inclined to believe that it is more common in lower vertebrates than has been as yet clearly ascertained. But the remarkable regurgitation of ruminants seems to be a specially developed function. Different groups of animals vomit with very varying degrees of facility. There is to my own knowledge in man a tendency to antiperistalsis in the œsophagus, if not the pharynx, independent of acid eructations. Some individuals experience this when there is interference with the regularity of the action of the bowels. Cases have been reported in which there seemed to be habitual regurgitation of food, like that of birds or even ruminants. Here again the most natural explanation seems to be that the alimentary canal of mammals, including man, retains a capacity to revert to a condition existing in a higher degree in antecedent forms; or, to interpret the matter slightly otherwise, that man retains a capacity which in some lower forms has been specially developed (ruminants, etc.), and which in himself, under certain abnormal circumstances, becomes greatly developed, — facts explicable by general community of descent.

In the cases in man referred to above, the mere law of habit does not of itself suffice to explain the facts: indeed, apart from the wider laws of descent, there is very little basis for the action of such a principle; there is no fulcrum for the lever, or, at best, a very unsteady one.

In diseases of the blood or blood-forming organs we have some remarkable instances of functional reversion. Though exact quantitative determinations of hæmoglobin are wanting for most lower vertebrates, there can be do doubt that in mammals the quantity of this substance furnished to the system within a given time is much greater than in those groups requiring less oxygen for their tissues, in consequence of a feebler cell activity. But in cases of anæmia in man the quantity of hæmoglobin may be greatly diminished, one result of which is that the subject is reduced not only as regards the condition of the blood, but in several other respects, to a state bearing a more or less close resemblance to life in the lower vertebrates. There is diminished activity in the locomotor, the nervous, and other systems of the body. The subject requires rest, careful feeding, quiet of the mind, etc. The treatment is unconsciously based on this fact of reversion. It may be stated, in truth, that the anæmic subject is unable to discharge the functions which are most characteristic of man, and that he naturally deports himself like a lower form. In leukæmia there is a still more marked reversion, for the blood in this disease approaches the condition found in the invertebrates, in which, as a rule, the red blood cell or hæmoglobin in any form is wanting. This being the case, it is not surprising that the disturbance of the normal functions is so great: the marvel is rather at man's capacity to adapt at all to such unnatural conditions; which, however, is clearer on the doctrine of descent from lower forms and in the light of the conception of physiological reversion than by any other explanation.

In that form of anæmia or chlorosis due to an imperfectly developed vasculai system generally, we surely have a clear instance of reversion, so marked that during the whole lifetime of the individual there may never be other than the most defective adaptation to environment.

Instances of cyanosis due to permanence of fœtal conditions of the circulation, and therefore resembling those normal to the frog and turtle, are such clear cases of human reversion as only to require mention.

In cases of valvular diseases with dilatation of the heart, or indeed any condition of this organ that permits of regurgitation with imperfectly aerated blood, we have similarly a reversion. It will be found that in not a few diseases of the heart, — in the condition of that organ during fainting; after shocks which have temporarily suspended many functions of the nervous system, and in consequence greatly imperilled life, — in all such cases it will be found that those parts of the heart the earliest developed in the history of the animal series are the very parts to continue their action latest. Now, this is at once fortunate for the mammal, and of great significance, inasmuch as the latest investigations show in the clearest way that the action of the ventricles is dependent on the functional integrity of the sinus and auricles, especially of the sinus. Suppose that the reverse were the case, and the sinus (or great veins) and auricles were the first to cease pulsating: the beat of the ventricle would be of comparatively little use; but apart from this, what explanation can be given of this peculiar sequence in the mammal independently of derivation from lower forms, which makes all clear? If this doctrine of physiological reversion went

[1] See a paper by Gage in the Proceedings of the American Association, vol. xxxiv.

[2] The writer discussed the subject of uric acid in a short paper in the *Medical News* for June 27, 1885.

no further than the circulatory system, it would throw a flood of light on the significance of otherwise obscure if not absolutely inexplicable phenomena. But it is to the nervous system that we must look for evidence which places the doctrine beyond cavil to a degree perhaps not equally clear in other parts of the economy.

When a mammal is poisoned by curare, by which the nervous influences normally reaching the tissues and regulating heat-production (and, as I believe, nutrition) are wholly or partially cut off, the mammal becomes virtually a cold-blooded animal. Its temperature rises and falls with that of the ambient air. This is one clear example of physiological reversion experimentally produced. It is, however, only one of many that might be instanced. It is well-known, and can be shown in the simplest manner, that when the head of a frog is removed, reflex action is more readily excited: the same applies to the removal of the cerebral lobes of the mammal. As Goltz has pointed out, one of the most remarkable results following removal of large portions of the cerebral lobes in the dogs which this experimenter kept under observation, is, as I can myself testify, the increase of reflex action. The animal becomes a sort of machine, which one may manipulate at will. A similar result follows in man when the higher centres of the cerebrum are rendered functionally inactive by disease or injury.

Now, in all these cases the animal loses its own peculiar character, and sinks to the level of some form lower in the scale. All will agree that the higher forms of true automatic (spontaneous) action in the physiological sense are dependent on the existence of the cerebrum. It follows, therefore, that the lower we pass in the scale of life, the more machine-like animals become.

Pathological reversion is most plainly illustrated by the results of hemorrhage into the cerebrum. Dr. Hughlings-Jackson has so well described the order and relation of the various events, that I shall here quote his own words in describing lesions of the cerebrum (*corpus striatum*), from hemorrhage: —

"It will be found that those parts suffer most and suffer longest which have the more voluntary uses. This is notorious of the arm and leg: the arm nearly always suffers more, and recovers later, than the leg. Of course, the distinction into complete and incomplete hemiplegia is artificial. There are all degrees of paralysis according to degrees of gravity of the lesion. But there is an order in which paralysis increases in increasing gravity of lesions. We observe that the graver the lesion, not only are the more voluntary parts (arm and leg) *more* paralyzed, but that the further spread in *range* is the paralysis, and the method of its spreading is from the more voluntary to the more automatic parts. Thus, neglecting very small clots, a considerable lesion paralyzes only the most voluntary movements of one side of the body, those of the face, arm, and leg, and these parts in degree according to their degree of voluntary use. A larger lesion not only causes a deeper and more permanent palsy of these three parts, but it leads also to implication of more automatic parts. In still larger lesions the palsy spreads to the *most* automatic parts of the body, even to parts supplied by ganglionic nerves. It produces stertor from palsy of the palate and palsy of the respiratory muscles and of the heart, — the palsy of respiration and of the heart showing itself chiefly in *slowness* of movement. There is also abasement of temperature." — REYNOLDS'S *System of Medicine*, vol. i.

I have intentionally quoted the exact words of this eminent investigator of the abnormalities of the nervous system constituting disease, so that their interpretation alone may rest with me.

It being granted that the lower we pass in the scale of animal life the more machine-like or automatic does the organism become, it will be clear, that, taking the various degrees or grades of paralysis as described above, we have likewise degrees of resemblance to lower forms; i.e., the graver the paralysis, the lower in the scale must we seek to find an animal comparable to man in this condition. The slowing of the heart and the lowering of the temperature are both modes of approach to the normal functional condition in cold-blooded animals.

When we add to this, or take by itself, paralysis of the muscles of the face, by which the expression peculiar to man is lost, we have a condition plainly like that in lower mammals, and, in extreme cases, even like that of the lower vertebrates, in which facial expression as determined by muscular action is minimal.

It must be conceded that the uneducated deaf-mute is in a condition mentally much nearer that of the higher mammals than is his uneducated fellow-man in possession of all his senses. But in aphasia, the result of disease or shock, there is in man plainly a marked reversion to a condition mentally resembling that in the 'dumb-brutes' about him.

In the case of the idiot we have an example of man in many respects inferior to the higher mammals.

But it is not my intention to treat the subject of psychological reversion in this paper. The subject is at once large, tempting, and, to my mind, furnishes evidence the most conclusive for the doctrine of descent with modification from lower forms as an explanation of man's nature.

One naturally looks about for an explanation of such remarkable facts as the order of muscular failure or paralysis as indicated in the paragraph quoted above. The entire brain may be separated from the medulla in a rabbit, and respiration still continue. The lower we descend in the animal scale, the more do we find the brain reduced to a mere repository for mechanisms adapted to regulate those processes constituting the so-called vegetative functions; but the question again and again recurs, 'Why in mammals, why in man, should the functions first to fail be those peculiar to them or to him, and not the reverse?'

The longer even in the lifetime of a single individual a certain form of muscular action has been practised, the less attention is required for its performance, the less voluntary, the more automatic it becomes. But would the duration of man's existence on this planet suffice to explain, on any system of gradual progression or functional improvement, the wonderful automatic action of all of those mechanisms essential to the maintenance of life?

The doctrine of descent renders the whole plain enough; and unless we adopt the view that man appeared suddenly and independently upon the scene, fully equipped for the battle of life, it seems but rational to assume that with all his departures, both by way of progress and retrogression, his functions are what they are by reason of such relationship as we are indicating. The morphologists have done much to account for the affinities of form or structure in the animal series: it remains for the physiologists to do their part in showing how the functions of the higher animals are related to the functions of the lower.

But once accepting this position, it is possible to explain phenomena following experiments on animals, and growing out of the experiments disease is producing, or, as I would prefer to say, the phenomena which are the deviations from the normal that constitute disease. Disease is no entity in itself, though we often use language which might lead to the belief that we so conceived of it.

When the normal adaptations to environment on which the very existence of an animal depends are disturbed, what more natural than that there should be a return to a functional condition prevalent in some ancestral group, or common to a host of such groups, as the case may be? T. WESLEY MILLS.

BOOK-REVIEWS.

Animal Magnetism. By ALFRED BINET and CHARLES FÉRÉ. (Internat. Scient. Series.) New York, Appleton. 12°.

THE nation that brought forth Mesmer, with his glittering display of charlatanry, has well atoned for this injury by bringing the study of hypnotism into general scientific recognition, and developing with a remarkable activity our knowledge of this obscure region of the human mind. Nowhere are so many men of science practically engaged in the study of hypnotic phenomena in all their various manifestations, nowhere are subjects so plentiful or so interesting, nowhere do we find so vast or so sound and constantly increasing a literature devoted to this field, nowhere else a journal devoted exclusively to the study of hypnotism, as in France. Although much that has been developed there is doubtless destined to be revised or rejected, yet the work is eminently scientific, and with few exceptions the workers have never deserted the field of painstaking, methodic study for the temptation of enlarging upon remarkable facts, liable to attract the popular imagination. The admission of a work on this subject into the International Scientific Series is therefore eminently fitting, and it is also right that the work thus honored should come from Paris, and more particularly from two pupils of Charcot, to whom, more than to any other single person, the admission of hypnotism as an accredited scientific proceeding is due.

The work itself is very well arranged, and introduces for the first time to English readers a fairly complete account of the modern studies in hypnotism. Our literature in this field is mostly concerned with the proofs of the genuineness of the states and accounts of remarkable performances, to the exclusion of the systematic study of the symptoms. The opening chapters are devoted to a concise history of hypnotism since Mesmer. The fate of this pretentious adventurer is full of interest. Mesmer appeared with his gigantic presumption, and offered a series of dogmatic propositions about the magnetic fluid coursing through the universe and influencing men. He next demonstrated to the satisfaction of the wealthy and frivolous Parisians the curative powers of this fluid. And his success was unparalleled; but, like that of most adventurers, his downfall was equally hurried. In 1784 a commission, including among its members Franklin, Bailly, and Lavoisier, was appointed to examine into the phenomena; and with commendable good sense they demonstrated the utter baselessness of Mesmer's pretensions, and ascribed all that occurred to the action of the imagination in nervously disposed individuals. Again and again is this same process repeated. A bold experimenter claims to have performed some remarkable feat; a commission is appointed, finds the pretension unwarranted, and dismisses the whole topic. A valuable prize was for several years open for any one who could read with a bandage across his eyes, as several subjects claimed to do, but no one ever successfully passed the tests. At last the scientific men were forced to the conclusion, that, while the more remarkable of the phenomena were probably exaggerated, enough remained to merit a real investigation, and that to refer every thing to the action of the imagination was no real explanation at all. This recognition was all that was necessary to give the impulse to the study of hypnotism as a more or less morbid manifestation of the nervous system.

The next chapters are devoted to the methods of producing the several kinds of hypnosis and the symptoms of the several stages. Here the authors follow Charcot's well-known three states, — lethargy, catalepsy, and somnambulism. These states are marked off from one another by distinct physical symptoms, and, though we have no satisfactory explanation of the reason why the raising or closing of the eye should cause certain subjects to pass from one to the other, yet the phenomena seem well enough established to be accepted as empirical facts. Again, the stages are found pure and typical only in hysterical hypnosis; and many subjects exhibit only one or two stages, and the symptoms manifested frequently diverge from what is here considered typical. The account of the symptoms is largely restricted to the more purely physical ones, which, though less striking, are much more convincing and valuable to the scientist. The writings of the pulse and the respiration, and of the curve of muscular fatigue, are figured, and speak more plainly than pages of description.

The psychological process most admirably illustrated by hypnotic subjects is that of suggestion, and to this Binet and Féré wisely devote a liberal portion of their pages. This process is simply unusually active in the hypnotic subject: it is exemplified daily in the influence of a strong-willed person over a weaker, of the teacher over the scholar; in short, "we have only to glance at social relations in order to see that individuals fall into two categories, — the leaders and the led; that is, the givers and the recipients of suggestions." These suggestions can be taken up by any of the senses, and, in brief, suggestion may be defined as the execution of an act through the intervention of the psychic faculties, the original impulse coming from another individual. One school of students of hypnotism (often known as the School of Nancy) regard all the facts observed in hypnotic states as due to suggestion, conscious or unconscious; and their explanation of such phenomena as the action of a magnet in transferring sensations from one side to the other, of the supposed action of drugs at a distance, of mind-reading, is that these effects are due to the unconscious suggestion of the results by the operator. The hypnotic state makes the subject keenly on the alert for the remotest hint; and many cases where the expected has been guessed at with a remarkable shrewdness, far beyond the capabilities of the subject in a normal condition, are on record. The Paris school, on the other hand, regard suggestion as applicable to only a portion of the phenomena, and hold that certain purely physical symptoms are produced with which consciousness has nothing to do. For example: the methods of inducing sleep by passes, intense fixation, etc., the Nancy school regard as devices for impressing the mind of the subject with the idea that he is to be hypnotized, and that the same results follow from any signal to which the subject is accustomed; while the Paris school regard these physical manœuvres as of peculiar efficiency and influence upon the nervous system. Both schools agree that the process of suggestion is the key to a majority of the more striking hypnotic phenomena, and that a knowledge of the possibilities of suggestion is indispensable to every student of what is now termed 'psychic research.'

The chapter dealing with hypnotic hallucinations is full of interest. The instances of unilateral hallucinations, in which only one-half of the body, one eye, one ear, or whatever it may be, has responded to a suggestion, lead one to connect with them the theories regarding the action of the two halves of the brain. An important part of the investigation concerns itself with the genuineness of these hallucinations, for this is the field where simulation is to be guarded against at every step. Binet and Féré have elaborated a series of tests, which leave no doubt as to the conclusion that these induced hallucinations are real in every sense. If they are visual, as most of them are, they are doubled and refracted if a prism be interposed between the eyes of the subject and the imaginary image; the image is enlarged or grows smaller, as the right or the wrong end of an opera-glass is put to the subject's eyes; and so on. Another interesting type of hallucination occurs when the subject conjures up from a blank card a picture or portrait at the command of the operator. If the card be inverted, the supposed picture is seen upside-down: if another precisely similar blank card is substituted, the change is instantly detected, for the imaginary picture vanishes. The explanation is, that the abnormally keen sight of the subject has detected upon the apparently uniform surface some little mark, some trifling irregularity, and that this is sufficient to arouse the suggested image. This view is supported, to mention one fact of many, by the observation that at a great distance the subject no longer distinguishes between the card with which her hallucination was connected and other blank cards, while, if an opera-glass be given her, the image is again aroused when the right card is shown.

Under the term 'psychic paralysis,' the authors bring together a most interesting series of facts, which would perhaps be more fittingly viewed as psychic inhibitions. The type of the psychic process here specified is easily made clear. A subject is given the suggestion that a certain person in the room is invisible. From that moment on, she does not see him. If he places himself in her way, she tries to avoid him, but is sorely perplexed to understand the nature of the obstacle. A hat placed upon the gentleman's head is to her mysteriously suspended in the air, and so on. Now, in all such processes the subject sees every thing else: she has not been made blind, and the image of the invisible individual striking upon her retina makes her see him, in a sense. But the orders have been issued from the cortex that when such and such an image is impressed upon the retina, it shall not be converted into a sensation. While consciousness is at home, it is not at home to that particular sensation; or, as another writer has expressed it, it is the process we make use of when we cut a friend in the street. It is not that we do not see him, but that we make ourselves believe as far as possible that we do not see him. This process (though it is not so original with the authors as they claim) is sure to yield interesting results from future study.

The final chapters of the work deal with the question of the therapeutic value of hypnotism, its relation to the problems of responsibility, and so on. On all these topics the authors hold very sound opinions, and are as keenly alive to the dangers and possible abuses of hypnotism as they are to its importance as a department of experimental psychology or as a curative agent.

The volume can be warmly recommended to all anxious to acquire a familiarity with the most truly scientific work in this field, although it represents only one of many equally able productions of the French school. It should also be remembered that the authors are to some extent partisans of a definite school of hypnotism, and that some of the phenomena upon which they lay stress would be otherwise interpreted by other workers, or even entirely discredited. About nothing is this caution more necessary than the results these authors describe as due to the action of the magnet. As long as it has not been proved that the normal nervous system is to the slightest degree subject to magnetic influence, it seems premature to have it play so great a part in the observation of hysterical hypnotics; and the more so, as the same results have been obtained by suggestion; and, in so far as this has been ruled out, the results have failed to follow with other experimenters.

Lectures on Bacteria. 2d ed. Tr. by H. E. F. Garnsey. Rev. by I. B. Balfour. New York, Macmillan. 12°. $1.50.

THIS book is a translation of De Bary's 'Vorlesungen über Bacterien,' and, as Dr. Balfour states in his preface, has been prepared because there is at present no book in English which gives in like manner a general view of the subject of bacteria. It sets forth the known facts in the life of bacteria in their connection with those with which we are acquainted in other branches of natural history. The second edition of De Bary's lectures appeared in October, 1886; so that we have the researches into this abstruse field of science brought down to a very recent date. In the introductory chapter the author considers the position which bacteria occupy in the vegetable kingdom among the fission-fungi or *Schizomycetes*, and their structure. He then defines the meaning of the terms 'coccus,' 'bacterium,' and 'spirillum.' In speaking of these three forms, he says that they are so exactly represented by a billiard-ball, a lead-pencil, and a corkscrew, that no one requires for his instruction the costly models which are offered for sale.

The course of development of bacteria, and the distinction between the endosporous and arthrosporous groups, next receive attention. From this the author passes on to the consideration of the much-mooted question of whether there are specifically distinct forms, species of bacteria, and, if so, how many such species can be determined. In treating of this interesting topic, he says that species are determined by the course of development, and defines the term 'species' as the sum-total of the separate individuals and generations which, during the time afforded for observation, exhibit the same periodically repeated course of development within certain empirically determined limits of variation. In the list of those who believe that the bacteria may be distinguished into species, are Leeuwenhoeck, their discoverer, Ehrenberg, and Cohn. Among those who deny this, and who consider that the observed forms proceed alternately from one another, the one being converted into the other with a change in the conditions of life, are Billroth, who, in a publication issued in 1874, included all the many and various forms which he had examined in one species, which he named *Coccobacteria septica;* and Nägeli, who has supported the same views since 1877. Nägeli says that he finds no necessity for separating the thousands of bacterium-forms even into two species, but that it would be rash to speak decidedly on a subject that is so imperfectly explored. But he also says, that, if his view is correct, the same species, in the course of generations, assumes a variety of morphologically and physiologically dissimilar forms one after another, which, in the course of years and decades of years, at one time turn milk sour, at another give rise to butyric acid in sauerkraut, or to ropiness in wine, or to putrefaction in albumen, or decompose urine, or impart a red stain to food-material containing starch, or produce typhus, relapsing-fever, cholera, or malarial-fever. In commenting on this view of Nägeli's, De Bary truly says that our practical interests require that we should obtain a decided answer to the question of species; for it certainly is not a matter of indifference in medical practice, for example, whether a bacterium which is everywhere present in sour milk or in other objects of food, but without being injurious to health, is capable or not of being changed at any moment into a form which produces typhus or cholera. The scientific interest demands that the question should be set at rest. The opinion to which De Bary himself comes, in reference to this important question, is that it may safely be maintained that continued investigation has at length arrived at the decision that there is no difference, as regards the existence of species and their determination, between this and any other portion of the domain of natural history, and that species may be distinguished provided the course of development is followed with sufficient attention. The origin and distribution of bacteria, their vegetative processes, the effects of temperature and the presence or absence of moisture upon them, and the subjects of culture, disinfection, and antisepsis, are discussed by the author, but lack of space prevents us from following him into these subjects in detail.

One of the most interesting chapters in the book is that which treats of the causal connection of parasitic bacteria with infectious diseases, especially in warm-blooded animals. De Bary regards as proved the causal connection between the *Spirochæte obermeieri* and relapsing-fever, Koch's bacillus and tuberculosis, Neisser's gonococcus and gonorrhœa, and Koch's spirillum and Asiatic cholera. Among the diseases due to the action of bacteria, he reckons also traumatic infectious diseases, affections incident to child-bearing, and others connected with the formation of groups of ulcers, abscesses, and boils. He does not think that we have any precise determination of the nature of the contagium or miasma virum of malaria. The relation of bacteria to typhoid-fever and diphtheria in men, he regards as uncertain, notwithstanding Goffky's and Löffler's model investigations. The concluding chapter of De Bary's admirable *résumé* is concerned with the discussion of the diseases caused by bacteria in the lower animals and in plants, while this is followed by a conspectus of the literature of the subject, and notes on the text. The whole volume is admirably arranged, and we know of no book which gives so concise and at the same time satisfactory an account of bacteria as the one before us. It is well translated; and its revision by Dr. Balfour, who is professor of botany in the University of Oxford, is a sufficient guaranty of its scientific accuracy.

Catalogue of the Pedagogical Library, Philadelphia. Philadelphia, Board of Education. 12°.

WHEN Superintendent MacAlister went to Philadelphia from Milwaukee four or five years ago, he saw and felt the need of having at his command the best authorities on the history, science, and art of education. The Board of Education appreciated the need, and by liberal appropriations it has been made possible for Mr. MacAlister to get together the volumes for which he has now printed a catalogue. Naturally, he has only selected from the field of educational literature, and has made no attempts to cover it in all its extensiveness. What he has gotten together is a good working pedagogical library, and "it is believed that the selection made furnishes the essentials for a pretty thorough study of the history and theory of education in the past, as well as ample materials for dealing with the living questions of our own time." Therefore it is that this catalogue, while referring to this one collection only, really serves as a carefully selected bibliography of pedagogics. In this respect it is far more useful than that of Messrs. Hall and Mansfield, published a year or two ago. That is too diffuse to be really useful, and it is disfigured by hundreds of mistakes and typographical errors. We trust that professor MacAlister has printed a sufficiently large edition of his catalogue to permit its general sale.

Natural Resources of the United States. By J. H. PATTON. New York, Appleton. 12°.

THE present volume is a concise review of the resources of the United States, compiled from the publications of the various National and State departments, and from private information obtained from the State governments. Therefore the data are presumably, as a rule, reliable; and as the book deals not only with the mineral resources, but comprises others also, it will be found handy as a brief review of the whole subject. 324 of the 523 pages of the book are taken up by a report of the mineral resources, on which D. T. Day treats in his annual summaries. This part is followed by notes on mineral springs and health resorts. The following sections, dealing with the vegetable products of the United States, grain, fibre plants, and timber, are very superficial; that on grasses, such as are the basis of American stock-raising, is even more so, the whole subject being treated in nine pages.

In the book we find a considerable number of remarks on physical geography which show that the author's knowledge of this subject is not very extensive. The authorities he quotes for his views are not those which are recognized by modern science. Maury's 'Physical Geography of the Sea' is not in accordance with the views held nowadays; neither are primers on geography good authorities. It is meaningless to say that the valley of the Mississippi 'greets the south,' as its slope is southward. The author would have us believe that this southward exposure affects its climate, while practically it has no influence whatever. Passages like this are numerous in the book. On the whole, it may be considered a fair account of the subject, sufficient to meet the wants of the general reader, although the author's teleological views lead him to a considerable number of statements which will not be conceded by scientists.

NOTES AND NEWS.

Prof. Anton De Bary died at Strassburg on Jan. 19, aged fifty-seven years. He had been suffering for several months of carcinoma of the face, and had undergone an operation, but without recovering. He had held the chair of botany at the University of Strassburg since 1872, being called there from Halle. He had studied botany at Berlin under Alexander Brown, and was made professor of botany at Freiburg at an early age. His first publication, 'On the Fungi causing "Rusts" and "Smuts,"' in 1853, attracted much attention. While the anatomical methods of other authors had somewhat increased our knowledge of the *Thallophytes*, De Bary's method of tracing their life-history opened a new era in this study. For a few years he was engaged in studying certain algæ, but he soon returned to his favorite study, that of fungi. In 1864 he published the first number of the *Beiträge zur Morphologie und Physiologie der Pilze*, which was followed in 1865 by further studies on parasitic fungi. Here he traced the whole life-history of several parasitic fungi from their entrance into the host through all the various stages. He showed that the 'rust' of the wheat is identical with the *æcidium* of the barberry, and thus was the first to prove the occurrence of heterœcism. These observations and their startling results led to the extensive study of cultures which has been carried on so successfully since that time. In 1866 De Bary brought out the first edition of the 'Morphologie und Physiologie der Pilze, Flechten und Myxomyceten,' the second edition of which, thoroughly revised and brought up to date, was published in 1884 as 'Comparative Morphology and Biology of the Fungi, Mycetozoa, and Bacteria.' Both these editions were the standard books on the fungi, and gave for the first time a comprehensive review of the subject, much of their contents being the results of De Bary's own studies. The third number of his *Beiträge* appeared in 1870; but at the same time he published numerous memoirs, among which we mention that on the epidermis in the *Botanische Zeitung*, of which he had become editor after Von Mohl's death. Since 1866 he has been working on the 'Comparative Anatomy of the Ferns and Phanerogams,' but it was only in 1877 that the results of his researches were published, — a monument of De Bary's faculties of observation, his accuracy and extensive critical reading. The influence of this book in the botanical world has been enormous. In 1885 appeared his 'Lectures on Bacteria' in the form of a book. While the style of this book is attractive and clear, it abounds in new facts brought to light by De Bary's researches, among which the study of the development of the spores of *Bacillus Megaterium* takes a prominent place, and gives a comprehensive and critical review of the whole literature of the subject. As a teacher he was eminently successful, and the influence of the Strassburg school upon the development of botany and biology has been very great. Although he was not a brilliant lecturer, he knew how to excite the enthusiasm of students who worked in his laboratory; and all who worked under his direction were so impressed with the truthfulness of his nature, his justice, modesty, and kindness, that so long as his pupils live he will not be forgotten.

— In his bulletin for December, 1887, Mr. J. R. Dodge, statistician of the Department of Agriculture, has an interesting note on the British wheat-supply for the last fifteen years. Great Britain absorbs a large portion of the wheat-supply of the world, and, if it is determined where its supply comes from, we ascertain thereby where a surplus of wheat is grown. Since 1874 the largest national product has been that of the United States. France comes second, although she imports more than she exports, and India third. Russia occupies the fourth position. By analyzing the official statistics of Great Britain, we find where the needed wheat has been obtained, and in what proportion each source of supply has contributed. From 1872 to 1886 inclusive, the United States has furnished in grain and flour 51.1 per cent, and for eleven months of 1887 the proportion has increased to 64 per cent. Russia in fifteen years averaged 13.6 per cent of the whole, and for 1887 only 5.4 per cent. India contributed an average of 7.9 per cent, and for 1887 11.3 per cent, which is the smallest percentage in the last five years, and a marked decline in absolute quantity from the previous year. Australasia fluctuates greatly in its contribution, averaging 3.9 per cent for fifteen years, and less than 2 per cent for the sixteenth. These three competitors of the United States have together furnished only 25.4 per cent, — less than half as much as this country during fifteen years, and a much smaller proportion in 1887.

— Mr. William Ellis, president of the Royal Meteorological Society, reviewed, in his recent annual address, the work and object of the society, which, although unable to carry out expensive original or experimental work, has a considerable influence upon the development of the science of meteorology. Mr. Ellis remarked that the society has succeeded in inciting volunteer workers throughout the country to united action, of which one recent example was the ready response to the request of the society for photographs of lightning, an excellent collection of which had been obtained, and which would shortly be exhibited; in addition to which, arrangements were being made for the more systematic observation of thunder-storms. Referring to the question of sympathetic relation between sun-spots and magnetism and meteorology, he thought that any complete treatment of the question in its meteorological aspect seemed to require that it should be dealt with in a much more comprehensive manner than before, for which purpose observations more completely covering the surface of the globe might be necessary, if indeed not necessary also for the solution of many other meteorological questions, the present meteorological stations being distributed over the earth in such isolated clusters. The attention given to synoptic charts was most important, but the general meteorological characteristics of places should also still continue to be studied. After remarking upon other matters, he laid before the meeting tables showing the monthly means of amount of cloud from observations made in three different series at the Royal Observatory, Greenwich, extending in all from 1818 to the present time. In concluding, Mr. Ellis said that at one time the science of meteorology seemed likely to form an exception to the general rule of advance, for, more than any other, it has required the united action of many workers; but the field of inquiry of late years opened out allows us already to talk of the new or modern meteorology, — phrases typical of the advance achieved, although the knowledge gained seems only to remind us of how much has yet to be done. The Royal Meteorological Society has at present five hundred and twenty-two members. Dr. William Marcet was elected president for the ensuing year.

— A firm in Yokohama, Japan, is now manufacturing the excellent Auzoux models of human anatomy at low prices, as a correspondent learns by private letter.

— In *Science* of Feb. 3, p. 57, 1st column, 21st line from bottom, 'thallophytes' should read 'protophytes.'

— In *Science* of Feb. 10, p. 67, 1st column, 35th line, 'Herndon' should read 'Heudon,' as also throughout the paragraph.

— In *Science* for Feb. 10, p. 69, 2d column, 27th line from bottom, '$2' should read '$1.'

— Leaflets Nos. 7 and 8 in the series issued by the Industrial Education Association (9 University Place, New York City) have reached us. No. 7 is an able and concise paper on the scientific treatment of education, and No. 8 gives an account of progress in the New York City schools in 1887. This series is having a large circulation, and doing great good; for the phenomenally low price

— one cent each, or two cents postpaid — at which these leaflets are issued put them within the reach of all who care to keep posted as to educational progress in any part of the world.

LETTERS TO THE EDITOR.

**** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

Twenty copies of the number containing his communication will be furnished free to any correspondent on request.

The editor will be glad to publish any queries consonant with the character of the journal.

The Scientific Swindler Again.

A young man of gentlemanly bearing, who calls himself Dr. S. M. Gutmann, and claims membership in the American Chemical Society, has been lately imposing on various members of the scientific fraternity in New York and vicinity. He claims to be a pupil and son-in-law of Professor Hofmann of Berlin, and shows letters purporting to come from some well-known persons, who recommend him as an expert in the manufacture and analysis of coal-gas. He is familiar with the names of chemists and physicists in this country, and uses them with freedom by way of introduction to strangers. He represents himself to be in pecuniary straits, as the result of long and fruitless efforts to obtain employment since his arrival in this country.

Since there are many readers of *Science* whom he will attempt to victimize, it may be well to warn them against this plausible and mendacious vagabond. W. LeConte Stevens.

Brooklyn, Feb. 10.

Psychics, or the 'New Psychology.'

The 'new psychology' is a term I have noticed cropping up of late, used as the expression, the 'new chemistry,' or any similar phrase, might be to indicate a late and advanced state of a science, such as may properly bear out the word 'new' in comparison with an old or former less-advanced stage of evolution of a given subject. Referring to several dictionaries at my elbow, I find the word 'psychics' defined as 'the same as psychology,' and marked '[Rare.]' in one of them.

In this connection, I beg leave to quote a sentence from a little treatise on psychics entitled 'Can Matter Think?' published in 1886, where I say (p. 29), "I have said what I think the excellent word 'physiology' should really mean. But I wish that the sadly abused term 'psychology' could be rooted out of the dictionary, or consigned to the same limbo where 'theology' has already been put by sound science and wise philosophy. 'Psychology' means any thing, from the vagaries of superstitious spiritualism to a system of mental philosophy or a code of metaphysics. As we have the good word 'physics' for all the physical or rupic sciences, I should like to see 'psychics' replace psychology, with the distinct understanding," etc.

What I mean by this word is precisely what seems to be implied by the expression 'the new psychology;' and many may be inclined to agree with me, that 'psychics' is a short, handy name which commends itself, or, so to speak, carries its own credentials.

A propos of words, did not *Science* (or was it *Literary World* of Boston?) discuss lately the propriety of the adjective 'sciential' as a desirable new coinage to characterize any thing pertaining to science? If so, it may not be generally known that 'sciential' is Miltonian, as in the lines, —

> "But first, low reverence done, as to the power
> That dwelt within, whose presence had infused
> Into the plant *sciential* sap."
>
> *Paradise Lost*, ix. 837.

— where the meaning is 'science-making' or 'productive of knowledge,' — exactly what 'scientific' literally means, though such literal sense is not implied in the ordinary usage of the word, which 'sciential' was proposed to replace. Elliott Coues.

Washington, D.C., Feb. 13.

The Expansion of Pine Wood through Absorption of Water.

During the summer of 1886, while seeking for a method for securing a measure of the soil moisture, I conducted an experiment to discover the amount and rate of the expansion in a section of white pine wood in passing from a state of complete saturation to one of complete dryness. While looking over my notes, I find the data, and, as the experiment was carefully performed, have thought that possibly the results may be worth putting on record. The results secured were as follows: —

Date. (1886.)	Weight of Section. (Grams.)	Per Cent of Water, calculated on Dry Weight.	Length. (Inches.)	Per Cent of Expansion, calculated on Dry Length.
Aug. 22	505.0	22.76	11.12	5.30
" 23	475.4	17.91	11.12	5.30
" 24	54.4	12.70	11.10	5.11
" 25	440.5	9.25	11.08	4.92
" 26	428.5	6.27	11.02	4.37
" 27	423.7	5.08	11.02	4.37
" 28	412.7	2.35	10.84	2.46
" 29	407.9	1.16	10.68	1.14
" 30	407.9	1.16	10.68	1.14
Sept. 1	403.2	–	10.56	–
" 2	403.2	–	10.56	–

A section two inches in length was sawed off from the end of a sound, unchecked, white pine board, one and one-eighth inches thick, and of such a width that the section when completely dry was 10.56 inches long. The section was then immersed for thirteen days in a tank containing spring water, of which the temperature was about 60° F., to secure saturation. It was then exposed to the air of a dry room, and its weight and length noted daily until it ceased to lose weight, after which it was placed in a drying-oven and completely dried. E. S. Goff.

N.Y. Agric. Exper. Station, Geneva, Feb. 9.

Queries.

28. Floating Drops versus Floating Needles. — In order that drops of water may float on the general surface, there must be entire absence of any thing which might diminish surface-tension. But the text-books, even the last edition of Ganot's 'Traité de Physique,' direct us to slightly grease needles before dropping them upon the water. Stanley, on p. 49 of his book on fluids, asserts that a polished steel wire one inch long and five-hundredths of an inch in diameter just floats if thoroughly cleaned with caustic potash and wiped dry to prevent oxidation. He says, "If there was the smallest particle of grease upon the wire, a much less diameter only would be supported." And in the same book are experiments to prove that a wire should be wetted in order to float. It may be that slightly greasing a needle does more good by smoothing over an imperfectly polished surface, than harm by diminishing surface-tension; but the phenomenon of floating drops appears to me to confirm the statement in quotation-marks above. Will some one kindly inform me where I can find a discussion of the statements of Stanley on this subject? F. C. Van Dyck.

New Brunswick, N.J., Feb. 11.

Answers.

20. Star of Bethlehem. — Three distinct objects have been confounded in the public mind; viz., the planet Venus, Tycho's new star of 1572, and the apparition called the Star of Bethlehem. The brilliant object visible in daylight was Venus. Tycho's star was visible in the north in the constellation of Cassiopeia in 1572, and has been thought by some, on the slenderest evidence, to be a variable of long period, which might re-appear about this time. A good account of it is found in Humboldt's 'Cosmos,' Vol. III. Chapter IV. For an account of the theories about the Star of Bethlehem, consult the unabridged edition of Smith's Bible Dictionary, Vol. III., under the heading, 'Star of the Wise Men.'

H. A. Howe.

University of Denver, Feb. 4.

Calendar of Societies.

Missouri State University Club, Columbia, Mo.

Feb. 6. — J. C. Jones, Volapük : the New International Language.

Biological Society, Washington.

Feb. 11. — Theo. Gill, Character of the Family *Elacatidæ* ; Robt. T. Hill, The Variations of *Exogyra Costata*, Say ; The Variations of *Gryphæa Pitcheri*, Morton ; C. V. Riley, The Insectivorous Habits of the English Sparrow ; C. Hart Merriam, A New Fox from California.

Anthropological Society, Washington.

Feb. 7. — John Murdoch, Siberian Origin of some Customs of the Western Eskimo ; W. H. Holmes, Ornamental Fabrics from the Graves of Peru.

Engineers' Club, Philadelphia.

Jan. 21. — C. H. Ott, A Peculiar Case of Transmission of Vibrations and Pulsations through Structures ; L. M. Haupt, Extracts from the Report of the Chief of Engineers with Reference to the Theoretical Operation of Submerged Jetties.

Appalachian Mountain Club, Boston.

Feb. 3. — F. H. Chapin, Ascents in the Front Range, Colorado.

Election of Officers. — President, Augustus E. Scott; vice-president, Rest F. Curtis; recording secretary, Rosewell B. Lawrence; corresponding secretary, Frank W. Freeborn; treasurer, John E. Alden; councillors, George Dimmock, George H. Barton, John Ritchie, Jr., Frank O. Carpenter, Frederick D. Allen; trustee, Charles W. Kennard.

Boston Society of Natural History.

Feb. 15. — G. L. Goodale, The Life and Work of Dr. Asa Gray.

Engineers' Club, St. Louis.

Feb. 1. — Carl Gayler, Highway Bridge Floors; B. F. Crow, Constructive Accounts.

Publications received at Editor's Office, Feb. 6–11.

ANTHROPOLOGISCHE Gesellschaft in Wien, Mittheilungen der. Ed. by Franz Heger. Band XVII. Wien, Hölder, 1887. 294 p. 4°.

BINET, A., and FERE, C. Animal Magnetism. New York, Appleton. 378 p. 12°.

CHAMBERLAIN, M. A Catalogue of Canadian Birds. St. John, N.B., J. & A. McMillan. 143 p. 12°.

CLAYPOLE, E. W. The Lake Age in Ohio. Edinburgh, Maclachlan & Stewart. 42 p. 12°. 75 cents.

COLLECTORS' Advocate. Vol. I. No. 1. January, 1888. *m.* Cincinnati, O., Charles Tarvin. 8 p. 12°. 20 cents.

ERDE, Die. Lief 16–20. Leipzig, Hartleben. f°.

FOLIE, F. Annuaire de l'Observatoire Royal de Bruxelles, 1888. Bruxelles, Hayez. 592 p. 24°.

HUXLEY, T. H. A Course of Elementary Instruction in Practical Biology. Revised and edited by G. B. Howes and D. H. Scott. New York, Macmillan. 512 p 16°. $2.60.

LINDERFELT, K. A. Volapük. Milwaukee, Caspar. 130 p. 16°. 50 cents.

MACALISTER, J. Catalogue of the Pedagogical Library and the Books of Reference in the Office of the Superintendent of Public Schools, Philadelphia. Philadelphia, Burk & McFetridge, pr. 184 p. 12°.

McMASTER, J. B. Benjamin Franklin as a Man of Letters. Boston, Houghton, Mifflin, & Co. 293 p. 16°. $1.25.

NUTTALL'S Standard Dictonary of the English Language. New ed., revised by Rev. James Wood. New York, Warne & Co. 816 p. 12°. $1.50.

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PEABODY, A. P. Harvard Reminiscences. Boston, Ticknor. 216 p. 12°. $1.25.

PEABODY MUSEUM of American Archæology and Ethnology, Twenty-first Report of the Trustees of the. Vol. IV. No. 1. Cambridge, Peabody Mus. 19 p. 8°.

PELLEW, G. Woman and the Commonwealth : or a Question of Expediency. Boston, Houghton, Mifflin, & Co. 38 p. 8°. 25 cents.

RICHTER, V. von. A Text-Book of Inorganic Chemistry. Tr. by Edgar F. Smith. 3d ed. Philadelphia, Blakiston. 428 p. 12°.

WALKER, F. A. Memoir of William Barton Rogers, 1804–82. Washington, Judd & Detweiler, pr. 13 p. 8°.

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SCIENCE

FRIDAY, FEBRUARY 24, 1888.

WE CALLED ATTENTION a few weeks ago to the beginnings of a zoölogical garden at Washington. It now appears that plans for a similar undertaking have been in progress for some time in Boston, and are now made public in a correspondence between the park commissioners of that city and the Society of Natural History. Although only preliminary steps have yet been taken, the outcome appears to be that the park commissioners have agreed to place in reserve, and lease the society on a nominal rental for a long term of years, several pieces of land under their control, to be developed, under the auspices of the society, as natural-history gardens and aquaria, if the friends of the society will raise a fund of two hundred thousand dollars as a foundation for the enterprise. The society proposes to interest the general public in the matter by creating a new body of members, to be called 'garden members,' paying a certain annual sum for the support of the enterprise, and in return presumably receiving certain entrance privileges. In their reply to the proposal made by the Natural History Society, the park commissioners call attention to the peculiar situation of Boston, in that its territory is greatly divided by bodies of water and marsh, and its dry land by rocky ridges, causing the city to extend itself in a very irregular manner. This prevents the possibility of finding any one piece of land large enough for the proposed natural-history park, and leads the commissioners to suggest to the society the advisability of occupying several distinct pieces of land; so that the plan as developed includes a diversified but unwatered portion of Franklin Park, next the future pleasuring-ground of Boston, a section of the park below Jamaica Pond, and a salt-water basin, perhaps a quarter of a mile long, at City Point, South Boston. Such a division has never before, we believe, been attempted in a zoölogical garden, but, though obviously requiring a larger staff to operate it, has some advantages which should not be overlooked. It is thus possible to obtain for aquatic animals places specially suited to them, and to select ground of a very varied character for other parts of the garden without feeling dependent upon a great water-supply; while the establishment of the large marine aquaria at the very edge of the harbor has obvious advantages. Moreover, it brings all the citizens into near proximity to some part of the ground occupied. Another distinct feature in the plan is a most commendable one, though its advantages are not so apparent on financial as on educational grounds. The committee points out that the society has long developed its museum with the distinct purpose of making it auxiliary to the general scheme of education in the State, and within a recent time has given special attention to exhibiting the animals, plants, and minerals of New England, believing that its position as the leading natural-history society of this group of States imposes such a duty upon it. This same idea it would carry out in the proposed garden by making it in an especial way a reproduction of the true indigenous fauna of New England. For it is to be borne in mind, say the memorialists, "that with the increase of population, and the concomitant decrease of the indigenous wild animals; above all, with the modern excessive growth of city life, — the percentage of city children (and hence of all) who may ever hope to see, and still less to observe at their leisure, the living objects of their native State or country, is rapidly growing less. At the same time the importance of such observation and study, instead of decreasing in like proportion, is greatly enhanced. To the country boy it is of comparatively little moment whether he observes this bird or plant, or that, since he has usually definite ideas of all, drawn from frequent observation of many. But to the city lad it is of the utmost consequence that he shall be able to correct his less definite ideas — formed for the most part by hearsay, by books, or by pictures — by observation of the object itself." The enterprise now plainly depends on the public spirit of the citizens of Boston. It is the natural and proper outcome of the admirable park system of that city. The Natural History Society has had the plan in view for twenty years, and believes the time is now ripe for developing it. Surely no such scheme has ever been proposed in this country under more favorable circumstances, or with the promise of so powerful and substantial support. That the park commissioners perceive this, is evident from the readiness of their response to the application of the society's committee, and we shall look with confidence to a generous response from a city that has already done so much for science and education.

THE MOST IMPORTANT QUESTION discussed by the Department of Superintendence of the National Educational Association at its meeting at Washington last week was, 'How and to what extent can manual training be ingrafted in the public-school system?' It occupied the entire morning of the first day's session; and after the reading, by Mr. Charles H. Ham of Chicago, of a very thoughtful and eloquent paper, the discussion was taken up by a number of gentlemen, some of them the most prominent and influential educators of the country. Of all who participated in the discussion, only one, Mr. Marble of Worcester, — a gentleman whose idiosyncrasies on this subject we have lately criticised (*Science*, No. 257), — opposed manual training, he even going entirely beyond the limits of the question at issue in order to ventilate his views. The reports of the meeting which reach us go to prove that our previous judgment, that Mr. Marble knows nothing about manual training or the argument for it, was correct. We regret to understand, however, that at Washington he surpassed his previous efforts, and considerably exceeded the bounds of courtesy in his treatment of those who favor manual training. The consciousness that one stands alone in the wrong of so great a question as this, must be irritating, but it can hardly be offered as an excuse for the conduct in question. Argument by invective is becoming far too common in this country, and it is our duty to protest most emphatically against its introduction into educational discussions. The advance of a great educational movement is not to be checked by abusing either it or those who regard it with favor, and it was this abuse, without a line of argument, which made up Mr. Marble's fifty-minute harangue. President Butler, Dr. Belfield, and Mr. Newell very easily and briefly showed how entirely aside from the question it all was. The result of the discussion was the appointment of a committee of seven to draw up a course of study in manual training, and to report at the next meeting.

THE MISSISSIPPI PROBLEM.

THE improvement of the Mississippi River, on a large scale and systematic plan, enjoyed, from its inception to the last session of the Forty-eighth Congress, a most enthusiastic support. From the outset, the theories proposed as the basis of the work undertaken have been criticised and contested, but for a considerable time no opposition was directed to the constructions actually undertaken.

Happily all who had addressed themselves to the problem had been, so far as concerns the works in the bed of the river, substantially in accord as to the projects for the immediate application of the appropriations, while differing somewhat as to the reasons for the work recommended, and still more as to the results to be expected of them. In such a state of affairs, the work could properly be continued; since the concurrent opinion of all as to the work to be done would probably be right, though of the discordant reasons and diverse expectations of individuals, some, of course, must be wrong.

At the beginning of the session above referred to, a strong and determined opposition developed to one of the principal features of the work proposed. It was stated that the revetment of caving banks was unnecessary and wasteful, since the object of that work, the cessation of caving, would result from the contraction-works, or those designed to concentrate the water over the shoals.

Some of the most active champions of the improvement and of the commission by which it was being carried on, announced the discovery that this commission had effected an insidious and dangerous change in its original plan, by virtue of which the objectionable feature of bank-revetment had been introduced or made more prominent. It is without the present line of argument to contest this statement, several refutations of which have appeared in print. The issue is now squarely made between revetment and anti-revetment theories, and must be met on its merits. It makes no difference, in the decision of the question, whether the Mississippi River Commission have changed front on it or not; except, perhaps, that if they have done so, it has been in the light of four years' experience, which in itself would be a strong argument in favor of their later views.

The two theories are so antagonistic that compromise is scarcely possible. The revetment or protection theory makes prevention of caving by means of this class of work one of the prime causes of the improved condition of the river: the anti-revetment theory predicts the cessation of caving as a result of the contraction-works. The one would stop the deterioration of the channel, and cut off one of the principal causes of impaired navigation, preliminary to or concurrent with the effort to improve the channel: the other would attempt to remove the effect, while leaving the cause in full operation.

The hypothesis on which the anti-revetment theory is based is very simple. It is assumed that the ability of flowing water to carry suspended sediment is directly proportional to its velocity; that at any given velocity it can carry a certain normal quantity, refuses more, and is not content with less; that if undercharged it takes up the deficit from the adjacent bed, producing scour and caving; if overcharged it drops the surplus on the spot, causing a fill. A corollary of this is, that if the channel can be so regulated that the velocity will be uniform throughout its whole extent, and always bear the proper ratio to the supply of sediment, there will be no scour or fill in the bed or on the banks of the stream; the sediment supplied by tributaries will be carried without loss or gain to the sea; the deterioration of the channel will cease; the bars, having been removed, cannot re-form; and the problem is solved.

As evidenced by their practice, engineers are overwhelmingly in favor of ideas the reverse of these. Many civil engineers have addressed themselves to the problem in the interest of individuals or corporations. No case is known where any of them have proposed any remedy for a caving bank, except a direct protection of some kind. When called upon to induce a scour along a bank, as in some cases of important landings, they have, strangely enough, successfully employed for that purpose the very means now proposed to prevent the same thing.

Such proponderance of professional opinion would be accepted in any question of law or medicine. In matters of engineering, however, the public demand not only that we shall be agreed, but that they shall be convinced. It is therefore necessary to further argue the question, and for the same reason the argument must be addressed, not to the profession alone, but to the public as well.

It is not proposed to test the hypothesis by any of the well-ascertained facts of the river's regimen. Thus no argument will be founded on the facts that by hypothesis the proportion of sediment should increase from the bottom to the surface, as does the velocity, whereas the increase is from surface to bottom; that the sediment should be greatest at the thread of swiftest water, and diminish toward either bank, as does the velocity, while, on the contrary, it is sensibly equal all the way across, and as often in excess on the slow as on the swift side; that a greater proportion of sediment should always be carried at a higher than at a lower stage, the reverse having been again and again observed; or that the rate of caving should be least when that proportion is greatest, which rarely or never happens. Nor will any attempt be made to weaken the force of this doctrine by pointing out any of the well-established causes of caving, such as outflow of ground-water, eddies, or whirls, and wash of wind or steamboat waves, which, being independent of the velocity, will survive any regulation of it which may be effected.

Inquiry will be made as to the applicability of this theory to the problem in consideration, or, in other words, whether the conditions under which the hypothesis is claimed to be effective can be produced in the Mississippi River. Should it be found that these conditions can be produced, the truth or falsity of the hypothesis could be quickly decided by trial. On the other hand, should it appear that the conditions precedent cannot be realized, the truth or falsity of the theory is immaterial.

The actual velocities or rates of current are, in the river's present state, any thing but uniform. Their distribution may be illustrated by the motion of the wheels of a cart driven over a crooked road. On a straight stretch, the wheels revolve with equal velocity. If a turn to the left be made, the right wheel is accelerated and the left retarded, and the reverse in case of a turn to the other side. If the curve be sufficiently short, the inside wheel stops; while, if still more abrupt, it must turn backward. Add to this that the top of each wheel moves faster than the bottom, and the motion of the water of the Mississippi and like streams is completely illustrated.

The channel of the Mississippi River is just such a road, and the relative velocity of its current at any point of its course may be readily predicated from the above analogy. The depth is always roughly proportional to the velocity. The highest velocity and greatest depths coincide on the concave sides of the bends, corresponding to the outside wheel on a curve, and it is here that the caving banks are found. On the convex side, deposits of sediment from the retarded currents are constantly being made, the accretions nearly, though not quite, keeping pace with the recession of the caving line opposite.

A word now as to the location and operation of the contraction-works, which are the means to be employed to bring about the required conditions. At every flood the river builds up its principal shoals, so that the bottom is as high as the surface of the water at the lowest stage. Low waters, such as now occur, would be impossible but for the fact that the river, in falling, cuts a channel for itself through these barriers. Were these natural channels suitable and sufficient for navigation, river improvement would be without its strongest claim to public support. They are unsuitable by reason of the uncertainty when and where they will form, and their frequent tortuousness. When they are deficient, it is usually by reason of a division of effort whereby two or more small channels are formed by an expenditure of the work which would suffice for a single one of sufficient size.

Above and on these shoals the contraction-works are to be placed. Their effect will be to localize and accelerate the natural channel cutting, but not to increase the amount of energy so expended. The amount of material scoured from the shoal nearly or quite equals each year the amount deposited on it. Otherwise the river would shut itself up. If so little as one per cent of the material deposited in a year on any shoal remained there permanently, the shoal would be raised perceptibly each year, and, within the recorded history of the river, should have become a dam as high as the banks, to turn the river out over the country. The regulated river, flowing through the contraction-works, can remove from the shoal each year but a small excess of material over what is deposited on it, and this for a limited period only: ultimately it can not, and by our hypothesis must not, carry away any excess.

It appears from the foregoing that the aggregate amount of material scoured from any shoal will not be sensibly changed by the contraction-works. The amount passing through in suspension cannot be affected at all: hence the total amount in suspension in the bend below will not differ. That the volume of water discharged will not be affected, it is scarcely necessary to argue. These two quantities unchanged, their quotient, which is the degree of saturation, cannot be modified by the contraction-works: for their effect on the distribution of velocities in the bend below, it is only necessary to point to the portion of the river below Baton Rouge. Here the conditions prescribed for a regularized river obtain in greater perfection than can possibly be realized on the river above. Yet in this ideal stream the distribution of velocities follows the cart-wheel analogy as closely as anywhere else.

To sum up, the effect of the contraction-works on a shoal, upon the conditions existing in the bend below, is simply nothing, — nothing as to the distribution of velocities, and nothing as to the amount of sediment carried.

In the face of this conclusion, the changes required by our hypothesis, before it agrees to stop the caving, are quite discouraging. It asks nothing less than the complete reversal of present conditions. It requires that the restraint of a fundamental hydraulic law be removed, so that the water may move at the same velocity at bottom and surface. It demands that the rapid currents along the caving banks be checked, and the sluggish ones on the other side quickened; that sediment shall be deposited in places whence it is now removed, and removed from those where it is now deposited. These revolutions of the river's regimen, as results of works at a distant point, and which have, as has been shown, no effect upon the conditions to be changed, are severally and equally impossible. The greatest actual velocity will be found, as now, in front of the caving bank. If the lesser velocity at the contraction-works be sufficient to produce scour there, the greater velocity at the point of caving must also scour and the caving continue. If the velocity along the caving bank correspond to saturation, so as to prevent caving, the lesser velocity on the shoal must allow deposits, and navigation will be injured.

The disparity in velocities is utilized by steamboats, the down boats being assisted by the rapid currents in the bends, while the up boats take advantage of the slack water on the other side. Uniform motion all the way across would retard the former preceptibly, and the latter fifty per cent. It is now difficult to get up stream enough pieces to accommodate the down-stream traffic. With uniform motion, it would be impossible. Navigation will suffer by the most cautious bestowal of such benefits.

A more general view leads to the same result as the local one. Suppose the channel to have been regularized from Cairo to Baton Rouge as completely as it now is below the latter point. In this conduit, the water supplied by its tributaries is to flow under the conditions that it shall always have the normal charge of sediment due to the velocity, and that it shall neither erode the channel nor make any deposits therein. No sediment being derived from action on the bed, the supply must come entirely from the tributaries.

The tributaries differ widely in their turbidity. The Missouri is the largest silt contributor, furnishing much more than all the others together. After it, but still classed as muddy, come the small streams on the east side above Memphis, the Arkansas and the Red. The Ohio, St. Francis, White, and Yazoo are comparatively clear. If our regularized channel be adapted in size to carry Ohio water without scour or fill, deposits must result when the Missouri predominates. If the channel be such that Missouri water can be carried without loss or gain of sediment, scour and caving must be expected when the supply is mainly from the Ohio. If a mean be taken, the scour and fill will alternately occur, which is simply a relapse into the present difficulties. No natural adjustment by mixture is possible, since the streams named have drainage areas lying in widely different latitudes, and it is rarely that their rises or floods are co-incident.

Suppose, again, that the corrected channel just below Cairo is filled to a certain level with just the right mixture of Ohio and Missouri water, having the normal charge of sediment due to its velocity, and carrying it without loss or gain. A slight rise comes out of the Ohio. Bringing an insufficient supply of sediment, it reduces the degree of saturation in the trunk stream. In order that scour and caving may not begin, this addition of water must be accompanied by a decrease of velocity and a rise of surface. If the rise, on the other hand, comes from the Missouri, the case is reversed, and, in order to prevent deposits and shoals, the velocity must be increased without a corresponding rise in surface. To realize either set of conditions requires an inverse ratio between velocity and slope, which is a blow at the fundamental law of the universe, that of gravitation. These contradictory requirements are repeated all along the river's course. The Forked Deer, Obion, and Wolf Rivers must produce an effect on the main stream directly the reverse of the St. Francis; the Arkansas, of the White; and the Yazoo, of the Red. The velocity of the river must conform to the supply of sediment, or the hypothesis will be violated. The supply of sediment is fortuitous: hence chance must take the place of hydraulic laws in controlling the flow of the water.

There never has been a day in the known history of the river when caving was not in progress. The amount of sediment requisite to produce normal saturation and prevent caving must therefore be greater than the river has ever before carried. The demand is, that the river be made muddier, and kept so. How as to supply? Of the present contributions, a considerable part is to be cut off by the cessation of caving and scour, which are promised as results of the improvement. The tributaries remain; but of these, the only one worth considering, the Missouri, is already under improvement. The result of that improvement, if successful, will be a fixation of its bed, and a large reduction of its output of sediment. The maintenance of even the present supply of sediment in the trunk stream involves the degradation of the tributary. If the Mississippi is to be improved on such principles, the regulation of the Missouri must be stopped at once.

We see, that, while the demand for sediment is increased, the supply is largely reduced. A scheme of improvement, the vital feature of which is the production and maintenance of increased muddiness, promises as its results changes which must largely reduce the muddiness. Surely this is necromancy on a large scale.

The saturation hypothesis, whether true or false, and following it the anti-revetment theory and plan of improvement based thereon, must be entirely rejected so far as the Mississippi River is concerned; because the conditions under which it is claimed to act cannot be produced or maintained; because uniformity of velocity in any cross-section, or from one section to another, is impossible, either in natural or regulated channel; because the volume of water which controls the velocity, and the supply of sediment, the two factors which determine the saturation, are now practically independent, and in a regulated channel become absolutely so, thus making the combination of the two to produce normal saturation a matter of chance and not of law; finally and principally, because the hypothesis contradicts and defeats itself in that it requires an increased supply of sediment to produce results which, if realized, must make this supply a constantly decreasing quantity.

If the caving of banks is to be stopped, it must be done by means outside of the contraction-works, since the latter cannot produce the slightest diminution of caving. That they will greatly increase it, may be strongly argued both from theory and experience; but such is beyond the present purpose. SMITH S. LEACH.

MENTAL SCIENCE.

A Second Laura Bridgman.

THE recently issued report of the Perkins Institution for the Blind, where Laura Bridgman has spent fifty years of her life, adds another most interesting and promising record to the accounts of persons afflicted with this double infirmity. The number of persons deprived of both sight and hearing is larger than is commonly supposed, and gives no sanction to the common belief that the loss of one sense insures an unusually strong development of the others. From a psychological point of view, the value of such cases depends, first and chiefly, on the age at which the senses were lost, those cases being the most suggestive and valuable in which the loss is earliest; secondly, upon the degree of blindness and deafness, as well as the rapidity with which these senses lose their function, the most instructive inferences being deducible from cases in which the loss is total; and, thirdly, from the completeness and accuracy of the record of the person's capabilities and achievements at the various periods of life, and especially during early childhood. In all these respects the case of Laura Bridgman is a most phenomenal one. Her life-history is to the psychologist most fruitful of hints and suggestions, throwing clear light upon questions otherwise difficult of approach. It is an experiment of nature, and as rightfully gets the eager eyes of the psychological student turned towards it, as the transit of Venus attracts the gaze of every astronomer's telescope. The majority of cases of deafness combined with blindness, however, do not belong to this category. In many instances enough remains of hearing or sight, or both, to allow these to enter as a factor in the mental development of the individual, and to that extent to vitiate the exclusive inference as to the *rôles* that these senses play in the psychic life. Often, too, though sight and hearing are practically totally lost, the loss occurred at a period of life when the mind has begun to profit by the experience which these senses collect, and can for many years feed upon the material thus brought together. This independence of the intellectual centres from their food-supply of sensations after a certain age — the fifth to the seventh year for sight — has been proved by actual observation. The report above referred to mentions that there are between thirty and thirty-five blind deaf-mutes in Sweden, where a benevolent lady has organized a school for such defections, and not less than forty such in this country. Eight of these are mentioned by name; but in only two of these cases is the age mentioned at which the loss of the senses occurred, — the one at eleven years, the other at seven, but with enough sight remaining to distinguish color, — and in both these, as well as in a third case, hearing was not lost until the power of speech had been permanently acquired. But of all these cases, hardly excepting that of Laura Bridgman, that of Helen Keller deserves the most minute and careful study. A *résumé* of the facts concerning her condition, collected by Mr. Anagnos, the director of the Perkins Institute, cannot fail to be of interest.

Helen is the daughter of cultured and well-to-do parents, and was born in Alabama on June 27, 1880. When about nineteen months old, she was attacked violently with congestion of the stomach; and to the effects of this disease are referred her total loss of sight and hearing. Previously she is said to have been of perfect health, and unusually bright and active. She had learned to walk, and was fast learning to talk. The loss of her senses thus took place about seven months earlier than in the case of Laura Bridgman, though Helen seems to have been as much if not more developed at nineteen months than was the latter at twenty-six months. In both cases a slow recovery was made, and a painful inflammation of the eyes set in. It is recorded of Helen that she "soon ceased to talk, because she had ceased to hear any sound."

As her strength returned, she gave ample evidence of the soundness of her mental faculties. She learned to distinguish the different members of her family and her friends by feeling their features, and took an especial interest in the affairs of the household. The little hands were constantly busy in feeling objects and detecting the movements of those about her. She began to imitate these motions, and thus learned to express her wants and meaning by signs, to a remarkable degree. Just before completing her seventh year, a skilful teacher from the Perkins Institute — Miss Sullivan — was engaged for her. At this age Helen is described as a "bright, active, well-grown girl," "quick and graceful in her movements, having fortunately not acquired any of those nervous habits so common among the blind. She has a merry laugh, and is fond of romping with other children. Indeed, she is never sad, but has the gayety which belongs to her age and temperament. When alone she is restless, and always flits from place to place as if searching for some thing or some body." Her sense of touch is developed to an unusual degree, and enables her to recognize her associates upon the slightest contact. Her sense of smell is very acute, enabling her to separate her own clothes from those of others; and her sense of taste is equally sound. In this respect she has an advantage over Laura Bridgman, in whom both these senses were reduced almost to extinction. She speedily learned to be neat and orderly about her person, and correct in her deportment. The first lesson is an interesting epoch. A doll had been sent Helen from Boston; and when she had made a satisfactory exploration of it, and was sitting quietly holding it, Miss Sullivan took Helen's hand and passed it over the doll; she then made the letters d–o–l–l in the finger-alphabet while Helen held her hand. "I began to make the letters a second time. She immediately dropped the doll, and followed the motions of my fingers with one hand, while she repeated the letters with the other. She next tried to spell the word without assistance, though rather awkwardly. She did not give the double *l*, and so I spelled the word once more, laying stress on the repeated letter. She then spelled 'doll' correctly. This process was repeated with other words, and Helen soon learned six words, — 'doll,' 'hat,' 'mug,' 'pin,' 'cup,' 'ball.' When given one of these objects, she would spell its name, but it was more than a week before she understood that all things were thus identified." In a surprisingly short time Helen completely mastered the notion that objects had names, and that the finger-alphabet opened up to her a rich avenue of knowledge. Every thing had to be named, and she seemed to remember difficult combinations of letters, such as 'heliotrope' and 'chrysanthemum,' quite as readily and securely as shorter words. In less than two months she learned three hundred words, and in about four months she had acquired six hundred and twenty-five words, — a truly remarkable achievement. She still used her gesture-signs; but, as her knowledge of words increased, the former fell into disuse. Next verbs were taught her, beginning with such as Helen herself could act, as 'sit,' 'stand,' 'shut,' 'open,' etc. Prepositions were similarly mastered. Helen was placed *in* the wardrobe, and the sentence spelled out to her. 'Box is *on* table,' 'Mildred is *in* crib,' are sentences which she constructed after little more than a month's instruction. Adjectives were skilfully introduced by an object-lesson upon a large, soft worsted ball and a bullet. Helen felt the difference in size at once. "Taking the bullet, she made her habitual sign for 'small;' that is, by pinching a little bit of the skin of one hand. Then she took the other ball, and made her sign for 'large' by spreading both hands over it. I substituted the adjectives 'large' and 'small' for these signs. Then her attention was called to the hardness of the one ball, and the softness of the other; and so she learned 'soft' and 'hard.' A few minutes afterwards she felt of her little sister's head, and said to her mother, 'Mildred's head is small and hard.'" Even so arbitrary elements of language as the auxiliary 'will' and the conjunction 'and' were learned before two months of instruction had passed, and on May 1 she formed the sentence, "Give Helen key, and Helen will open door."

From this the step to reading the raised type of the blind was an easy one. "Incredible as it may seem, she learned all the letters, both capital and small, in one day. Next I turned to the first page of the 'Primer,' and made her touch the word 'cat,' spelling it on my fingers at the same time. Instantly she caught the idea, and asked me to find 'dog,' and many other words. Indeed, she was much displeased because I could not find her name in the book." She soon added writing to her accomplishments, and carefully formed the letters upon the grooved boards used by the blind. On the 12th of July she wrote her first letter, beginning thus: "Helen will write mother letter papa did give helen medicine mildred will sit in swing mildred will kiss helen teacher did give helen peach," etc. This well justifies the statement that she acquired more in four months than did Laura Bridgman in two years. Letter-writing is quite a passion with her, and, as she is also able to write by the Braille system, she has the pleasure of being able to read what she has written. Her progress in arithmetic is equally remarkable, going through such exercises as "fifteen threes make forty-five," etc. As examples of her powers of inference, the following will do service: she asked her teacher, "What is Helen made of?" and was answered, "Flesh and blood and bone." When asked what her dog was made of, she answered, after a moment's pause, "Flesh and bone and blood." When asked the same question about her doll, she was puzzled, but at last answered slowly, "Straw." That some of her inferences are not equally happy, the following illustrates: "on being told that she was white, and that one of the servants was black, she concluded that all who occupied a similar menial position were of the same hue; and whenever I asked her the color of a servant, she would say, 'Black.' When asked the color of some one whose occupation she did not know, she seemed bewildered, and finally said, 'Blue.'" Her memory is remarkably retentive, and her powers of imitation unusually developed. One of her favorite occupations is to dress herself up, — a performance which she accomplishes not always with success according to our ideas. Her progress continues, and each letter is a marked improvement upon its predecessors. A letter to Mr. Anagnos contains the following sentences: "My doll nancy is sleeping. She is sick. mildred is well uncle frank has gone hunting deer. we will have venison for breakfast when he comes home. I did ride in wheel-barrow and teacher did push it," and so on. Enough has been said to indicate the remarkable powers of this unfortunate child, and to give basis for the belief, that if her training is continued in a wise direction, and with a proper appreciation of the value of detailed and accurate investigation, the world will be able to read in the life of Helen Keller a most momentous psychological lesson.

EXPLORATION AND TRAVEL.

Tibet and Nepaul.

A SUPPLEMENT to the 'Indian Survey Report for 1885-86' has just been issued. It contains the description of a native surveyor, M—H, through eastern Nepaul and southern Tibet, of which the London *Times* gives the following extract: —

"The explorer crossed the Nepaul boundary near Dagmarathana, in Bhagalpur, and, after making customary presents, obtained a passport authorizing his further progress, which lay northward over the Mahabharat range, one of the spurs of the great Himalayan Mountains. At various points along the route his passport was examined, his goods searched, and a tax exacted from him, and in some cases he had, in addition, to propitiate the local authorities with presents. On July 24, 1885, the explorer passed a great temple, called Halsia Mahadeo, situated on a mountain-spur, and deputed his travelling-companion to visit and examine the temple, which is held in veneration in the neighborhood, and has been endowed with a large free grant of land. At Asaliakhark, a fort held by four hundred Nepaulese soldiers under a captain, whose duty it is to examine all passes brought by travellers from the south, and, after full inquiry, to grant fresh ones to those proceeding farther north, the explorer was subjected to much interrogation, as his pass was only available for Nepaul. As it was known that he intended penetrating northwards into Tibet, he was closely searched, interrogated, and directed to return by the way he came, the soldiers being ordered to keep him under surveillance for such time as he remained there. After being detained for six days, the explorer was able, by making suitable presents, to obtain permission to proceed, having persuaded the official that he and his party were inhabitants of Jumla, and that they were anxious to return thither by Dingri, Jonkhajong, and Kagbeni, as being the most expeditious route. Their further march lay pretty close to the Dudhkosi River, and at Jubang Tibetan inhabitants were met for the first time. Khumbujong, a little west of Mount Everest, is the residence of the governor of the Khumbu district. The official is a Tibetan, and has held the post for the last thirty years: he receives no pay from the Nepaul Government, but is allowed fifteen per cent of the net revenue of the district, and pays an annual official visit to Khatmandu. For a time the governor absolutely refused the party permission to proceed northwards by a route which he alleged had never till then been traversed by any Hindostanee or Goorkha. The explorer had therefore to make a lengthened stay at this place, during which he endeavored to ingratiate himself with the inhabitants by treating their sick. One of the commonest diseases in the locality was goitre, and, as he succeeded in curing the governor's daughter-in-law of this, he was naturally taken into favor, and secured the sympathies of her husband, Sunnam Durje. This last-named individual was about starting on a trading expedition to the north, and by the exercise of sufficient tact was prevailed upon to take the explorer's party in his train. The man eventually gained his father's tacit consent to the arrangement, and, after a six-weeks' enforced inactivity, the explorer again started on his way. On Sept. 23, near Pangji, the famous deity Takdeo ('horse-god'), a black rock, in shape like a huge horse, was passed. Out of deference to Takdeo, which is considered very sacred by the Tibetans, no ponies are allowed on the route over the pass. The Pangula Pass over the Himalayas, he says, is decidedly the highest and most formidable ever crossed by him: he estimates the height at over twenty thousand feet, but, owing to an unfortunate accident to his boiling-point thermometer, he was unable to estimate it more accurately. The ridge forms the boundary between Tibet and Nepaul. At Keprak, the first frontier village, the Tibetan official refused the party permission to go on, saying any such concession would cost him his life; but with the influence of their friend, Sunnam Durje, and by the exercise of a little diplomacy, a guide was eventually obtained to Dingri, across the great grassy plain called the Dingri Maidan.

"The town of Dingri, which has an elevation of 13,860 feet, consists of about two hundred and fifty houses, and the inhabitants are chiefly Tibetans, though there are five houses belonging to Goorkhas, and three or four to Chinamen, who have established themselves at this place for trading purposes. The houses are all stone-built, a tenacious whitish clay being used in place of mortar, and with flat roofs. The country round is well cultivated, but barley and peas are the only produce. The inhabitants all appear well-to-do. On the hill which rises immediately from the north of the town to a height of about three hundred feet, stands the stone-built fort occupied by the Daibung and forty Chinese officers, who are in command of about five hundred Tibetan soldiers. The Daibung is relieved once in three years, and during his tenure of office is allowed to trade within the limits of his province. There are said to be only three Daibungs, in all, under the Lhasa Government: of these, one resides in Lhasa, another in the Nam-Cho district, and the third at Dingri. The authority of the last mentioned extends from Shakia to the westernmost limits of Tibet, and he exercises both military and civil jurisdiction, short of capital punishment, within his territory. The trade in which the Daibung engages, so far as tea and salt are concerned, cannot be characterized as free. Each house in his jurisdiction is compelled to take one brick yearly from the Daibung at a high rate, and he realizes a large annual revenue from it. In addition to these two articles, he deals in blankets on the same footing as private traders. No gold is to be seen at Dingri: it is much sought after, and many inquiries were made of the explorer as to whether he had any gold, pearls, or coral to dispose of.

"The soldiers occupying the Dingri fort are armed with a sword, matchlock, and bow and arrows. The sword is the usual short, straight weapon, in wooden scabbard, met with all over Tibet; the matchlocks are sent from Lhasa; and the bows are made of bamboo which is brought from Nepaul. The soldiers manufacture their own powder on the spot. Lead is imported from Nepaul and Darjeeling; but, as bullet-moulds are unknown, they pour out the molten lead into a long, hollow scoop in the ground, and then clip it into convenient-sized pieces, which are hammered to suit the bores of the guns. The soldiers receive a small yearly pay (about £2 to £2 10s.), and are allowed to engage in agriculture, trade, etc. They are drilled by their Chinese officers every week or so, sometimes on foot, at other times mounted on ponies, which they maintain for themselves, and there are periodic inspections by the Daibung. At these inspections the soldiers always appear mounted, in uniform, and have to go through target-practice. For the latter a disk of leather, one foot in diameter, painted white, is suspended to a rope stretched across two poles. Each soldier in turn then rides full gallop across the field at about fifteen feet from the target, and fires as he goes past. Should he hit the mark, the officer in attendance with the Daibung scores a point. When all the soldiers have gone past in one direction, they return, firing in the same way as they go past the target, to their original position. They next go through the same course, using their bows and arrows instead of matchlocks. The Daibung then examines the notes of each officer, and for every point scored presents him with a khatag or kerchief. The explorer was not much impressed with the marksmanship he saw.

"As Dingri is situated on the high road from Lhasa westwards, it is the constant resort of traders, for whose convenience a serai capable of accommodating two hundred men has been built. The bulk of the goods is carried on mules, chiefly because they travel so much faster than either yâks or asses.

"Throughout the country from Bhagalpur to Dingri the chief articles carried northwards are tobacco-leaf, cotton-cloth, broad-cloth, iron, brass, and copper vessels, corals, and rupees, which are used for making jewelry; and for these the men of Khumbu go annually in parties to India, some even as far as Calcutta, taking with them musk-pods, yâk-tails, antelope-horns, blankets, and stuffed munal and argus pheasants. From Dingri are exported into Nepaul

Tibetan blankets, musk-pods, goats, ponies, clarified butter, and yâk-tails. The chief grain grown is maize or Indian-corn. The domestic animals comprise buffaloes, yâks, zobus (cross-breed between yâk and cow), goats, and sheep of the long-horned species, largely used in Tibet for transport purposes. The yâk and female zobu afford a plentiful supply of milk. Among the wild fauna are musk deer and Tibetan antelopes, while flocks of wild pigeons and ravens and pheasants are common.

"The Daibung was away when the explorer reached Dingri, and did not return till Oct. 21. Great trouble was experienced in getting him to accord permission for the party to proceed westwards. The Daibung declared that this route was absolutely closed to all but officials; but in consideration of the explorer's companion, who was a man of influence in these parts, and in consideration of his promise to be answerable for their good behavior, the required permission was granted, but with a proviso that from village to village a guide should escort the party and send back regular reports of the progress made.

"The general direction of the explorer's route then trended to the west, past the Palgucho Lake, about nine miles by four in extent, the waters of which are clear and sweet to the taste, though it has no outlet. The Tibetan fort of Jonkhajong, the farthest point to the north-west reached, is a substantial stronghold, about four hundred paces square, protected by a mud and stone wall. Two officials, called Jongpons (Tib. = 'governor of a district') reside here, and exercise civil and judicial authority short of capital punishment. The surrounding country appeared well cultivated, and the inhabitants were reaping their harvest at the time. The Jongpons gave permission for the party to travel to Nubri in accordance with the terms of the passport, but, as the route was reported to be closed by heavy falls of snow, it was only by more presents that a pass allowing M—H to proceed as far as Kirong was obtained. Beyond Kirong the route nears the river, and for about one hundred paces is carried over a gallery about six feet wide, run along the perpendicular face of the rock at a height of from fifteen to twenty feet above the water's edge. The gallery rests on thick iron bolts driven into the rock at intervals, over which planking is loosely laid: the outer edge is fenced by a rudely made rope passed round wooden posts fixed to the bolts. At Naiakot the route turned westwards, and, crossing the watershed of the Tirsuli River, descended into the valley of the Buri Gunduk, one of the chief rivers of Nepaul, which M—H ascended as far as Nubri, along a route nearly parallel with the line of his southward journey. Thence he retraced his steps along the Buri Gunduk to Arughat, a Nepaulese village, where the party were detained three days pending the result of inquiries as to whence they had come and for what purpose. The explorer professed to have gone all the way to Nubri in search of one of his dependants, who, he alleged, had run away from M—H's home in Jumla with a large sum of money some time before, but whom he had not succeeded in finding. He said that, having failed in his object, he was anxious to return home *viâ* Tirbeni, where he intended going through the customary religious observances. He was then allowed to proceed, but warned, that, owing to the disturbed state of the country consequent on the recent insurrection in Khatmandu, he was liable to detention in several places. His further route to Tirbenighat, on the British frontier, lay in a south-westerly direction."

ELECTRICAL SCIENCE.

Alternating Current Electro-Motors.[1]

THE alternating system of electrical distribution possesses many advantages for distributing electrical energy over extended areas; it has, however, certain disadvantages, among others that of not at present allowing the use of electric motors for the distribution of power.

In any central station supplying electric lights the full capacity of the plant is utilized but a short time during the twenty-four hours, and, taking the whole day, we will find that we have sold an amount of energy equal to a half or a third — perhaps even less — of the amount we could supply supposing we worked always at full capacity.

If we draw a curve representing the energy used at different hours of the day for lighting, it will be something like $O\ D\ E\ H\ F\ G\ X$ in Fig. 1. The total amount we could have sold is $A\ O\ X\ B$. If we can use motors on the circuit, we can sell an additional amount of power such that the power used for lighting and by the motors never exceeds the maximum capacity of the station. For instance, if the motors work until 6 P.M., we can use for them a horse-power equal to $H\ I$, and the total energy we can sell for the motors is $H\ I\ K\ L$. The solid part of our diagram is all of the energy that a purely alternating system can expect to utilize: a continuous current system, by employing storage-batteries, could fill the whole of the area $A\ O\ X\ B$.

In the alternating system the current and electro-motive force may be represented by the curves I and II, Fig. 2, the maximum

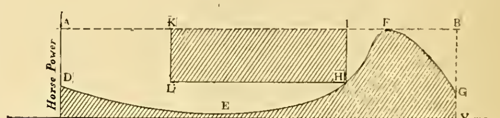


FIG. 1.

value of the current lagging behind the maximum of the electro-motive force. In the main circuit a high electro-motive force of constant maximum value is used, and this is reduced at points of consumption to the low potential necessary for safety, and for use with incandescent lamps, by 'transformers;' that is, by 'induction-coils' working backward. The value of the system lies in this: by using high potentials in the main or primary circuit, we can transmit a great deal of energy with comparatively little current, and therefore with little loss in the lines. This enables us to use small conductors, and avoid the large investment in copper necessary in distributing energy by the direct system.

If we can use motors in this system, we can almost double our receipts with comparatively little increase in our expenses. The plant remains the same; the salaries, interest on investment, and depreciation, are only slightly increased; our main additional expense is for the fuel.

The forms of motors that can be run by alternating currents are (1) an ordinary series-wound motor; (2) a motor built like an alternating current dynamo, the field-magnets being excited by the

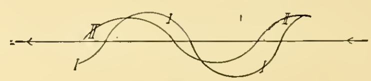


FIG. 2.

alternating current, which is first commutated so that its direction is always the same; (3) the same arrangement as the last, except that the field-magnets are excited by a continuous current from some external source; (4) the form proposed by Prof. E. Thomson, in which the armature currents are not supplied from any external source, but are induced in them by the alternations of the field-current.

Of these forms, (3) appears the most promising. Its advantages are, that when it is once started it will perfectly govern itself, revolving at such a speed that its own reversals of electro-motive force occur with the same rapidity as those of the dynamo driving it; it is cheap to construct, and durable; and it should be efficient, and give a greater output than corresponding machines of the other types. Its disadvantages are, that it must be first driven to its proper number of revolutions before the alternating currents will run it; there must be some external source of continuous current to excite the field-magnets; and if a load possessing any considerable inertia be suddenly applied, the motor will stop.

It is proposed to avoid these difficulties in the following way:

[1] Abstract of a paper read before the American Institute of Electrical Engineers, by Dr. Louis Duncan, Johns Hopkins University.

with the main circuits there should be run an auxiliary continuous current circuit from the central station, of a capacity of, say, ten per cent of the power to be supplied. This continuous current would have two uses: in the first place, it would excite the field-magnets; and, in the second, it would start the motor. This last could be accomplished by having a commutator on the motor-shaft that would reverse the current through the armature every time an armature coil passed a pole. Now, by a simple switch, we could first turn on the continuous current, which would start the motor, and then, when the armature had reached its proper number of revolutions, we could turn the handle a little further, and make the alternating circuit through the armature, at the same time breaking the continuous circuit.

To prevent the stopping of the motor on the sudden application of a load, there should be some form of friction-pulley on the shaft that would turn just before the motor had passed its maximum possible work.

The easiest way to decide which of the possible forms of motor is best, is to experiment on them all. It is not necessary to experiment on a number of motors of each form; but if we make suitable observations, and know how to draw deductions from our results, we can tell very closely, from experiments on one motor, what are the capabilities of the type.

Gas-Engines and Wind-Mills for Electric Lighting. — Up to the present there have been few private houses supplied with electric lights. The central stations have been placed in the more crowded business portions of the towns, and lights have not been distributed at great distances from them. There are other reasons why incandescent lights have not been more rapidly introduced: the general public has not had sufficiently brought before it the advantages of electric lighting over gas from an artistic and hygienic point of view; it has been considered mainly from the standpoint of cost as compared with gas. In many cities gas is supplied over extended areas, embracing sometimes the suburbs for miles around. For the more wealthy suburban inhabitants it would be easy to light their houses by electricity, using a gas-engine for power, and employing a storage-battery in connection with the dynamo. Some figures obtained at the late electrical exhibition in New York will be of interest. We find, if we consider a five-foot gas-burner as giving a light of 16-candle power, that 130 feet of gas supplied to a gas-engine will give as many incandescent lamps, these being fed directly from the dynamo, as would 150 feet of gas burned directly. If we use a storage-battery, and allow it 70 per cent efficiency, we have 30 incandescent lamps using 186 feet of gas, to 150 feet for the gas-burners. To the expense of the electric light, moreover, we must add the interest on the plant, depreciation, breakage of lamps, etc. These items will perhaps double the expense of the electric light. The cost could, however, be reduced if two or three people living close together would use the same plant: it could be still further reduced if cheap fuel-gas could be supplied for the engine. As far as cost goes, then, the electric lights supplied in this way would be more expensive than gas; but for people of means, the greater beauty of the light, and its healthfulness, together with the many smaller offices the electricity could be made to perform, would repay the increase in cost. Where there is no gas, it has been proposed to use wind-mills. Mr. A. R. Wolff states that a properly constructed wind-mill will govern itself for all velocities of wind exceeding six miles per hour; further, that on the average, for at least eight hours out of twenty-four, the wind exceeds this velocity. "Total calms in excess of two days' duration are practically unknown in the United States." If these figures are correct, it is evident that we can use wind-mills in connection with storage-batteries for supplying light to country houses. It should be borne in mind, however, that isolated plants of this kind must have a capacity very much greater than the mean power required; and in this case, where we may have calms of two or perhaps three days' duration, the capacity must be sufficient to last over this time. Counting the interest and depreciation, and the breakage of lamps, it will probably be found that the cost will be greater than that of oil; but there is no comparison as regards convenience and beauty, and it is probable that the wind-mill will be used as a source of power for lighting the houses of rich country people.

ETHNOLOGY.

Christmas Customs in Newfoundland.

The Rev. Moses Harvey of St. John, Newfoundland, describes in the *Montreal Gazette* an interesting Christmas custom observed in Newfoundland. Formerly, he says, at this season, 'mumming' was carried on to a large extent; but the practice at last became an intolerable nuisance in the streets, and was put down by law. Firing salutes on Christmas Day, once a general custom, has also been prohibited, to the greater comfort of every one. A curious custom prevailed here on St. Stephen's Day (Dec. 26). It was called 'The Burying of the Wren.' Bands of boys and youths, with some rude musical instruments, went about the streets on that day carrying a green bough, to which were fastened ornaments of colored paper and either a dead bird or the figure of one. They called at the doors as they made their rounds, and sang a rude doggerel, of which the following was the burden: —

"The wren, the wren,
The king of all birds,
On St. Stephen's Day
Was caught in the furze.
Though he is little,
His honor is great,
So rise up, kind lady,
And give us a treat.
Up with the kettle
And down with the pan, —
A penny or 'tuppence'
To bury the 'wran.'"

The contributions thus levied by the youngsters were spent in the purchase of cakes and sweetmeats.

The custom is now almost extinct, but some faint and forlorn attempts are still made by a few boys to keep it up, and in a few years it will probably pass into oblivion. It is curious to find that a similar ceremony was once practised in the Isle of Man. In Waldron's works, published in 1711, in describing the Isle of Man, the author says, "Here, on the 24th of December, towards evening, all the servants have a holiday. They go not to bed all night, but ramble about till the bells ring in all the churches, which is at twelve o'clock. Prayers being over, they go to hunt the wren, and, having found one of these poor birds, they kill her and lay her on a bier with the utmost solemnity, bringing her to the parish church, and burying her with a whimsical kind of solemnity, singing dirges over her in the monks' language, which they call her knell, after which Christmas begins." It is evidently the same ceremony, in an altered form, that is practised here. What is its origin, how it came here, or whether it is kept up elsewhere on this side of the Atlantic, is not known.

BOOK-REVIEWS.

Harvard Reminiscences. By Andrew P. Peabody. Boston, Ticknor. 12°. $1.25.

This work, by the venerable professor of Christian morals at Harvard College, will be of much interest to graduates of the college, both younger and older, and by no means devoid of interest to the general reader. The author's reminiscences relate to the time when he was undergraduate, theological student, and tutor, but do not cover the period of his professorship, which he has now held for so many years. The state of things at Harvard in those olden times was so different from the present, that we can hardly repress a smile as we read of it. Thus, Dr. Peabody tells us that a student's room was usually destitute of all the means of comfort, and even of the tokens of civilization; that carpets were almost unknown, and friction matches entirely so; and that the entire furniture of the room, except the feather-bed, would not have sold for more than ten dollars. The relations between professors and students is described as one of mutual hostility; the students, in particular, considering the faculty as their natural enemies. As regards study, Dr. Peabody thinks that the best scholars did more work, and the poorer ones less, than they do now. The administration of the college affairs is described as loose and unbusinesslike until the elevation of Josiah Quincy to the presidency, when a thorough reform was carried out under that distinguished leader, whose previous experience as member of Congress and mayor of Boston had eminently fitted him for the work. Dr. Peabody gives many interesting accounts of the modes of teaching and lecturing pursued by the professors of whom he speaks, some of which are full of suggestiveness even now. He gives his personal recollections of nearly seventy men who held offices in the college, with excellent sketches of character and interesting anecdotes; and, though some of those of whom he speaks were hardly known outside the college, not a few had a national reputation. It is hardly necessary to add that the venerable author writes, as always, clearly and with hearty nterest in his subject.

The National Sin of Literary Piracy. By HENRY VAN DYKE. New York, Scribner. 16°. 5 cents.

THIS pamphlet is a vigorous protest against the absence in this country of an international copyright law, and against the unwillingness of our people up to this time to enact such a law. There is nothing in the author's argument that is specially new; but the moral principles involved in the subject have seldom been exhibited with greater force and clearness than they are here. Mr. Van Dyke's essay was originally a sermon, and the mere fact that a sermon on the subject could be preached to a popular audience is proof that public interest in the question is already awakened. The author treats the subject from a moral standpoint, maintaining that we have no more right to take a foreign author's work without paying him for it than we have to take any other man's work, literary or otherwise, in the same way. He treats as irrelevant the argument, sometimes adduced by the opponents of international copyright, that the American people want cheap literature. "The question is," he remarks, "how do they propose to gratify that desire, fairly or feloniously? My neighbor's passionate love of light has nothing to do with his right to carry off my candles. The first point to be determined is one of righteousness." He holds, however, that the republication of foreign works is not only wrong, but injurious to our own people, both by hindering the growth of our national literature, and by helping to weaken the national conscience. The book will be found interesting by all who are interested in the subject, and, if read by the right persons, can hardly fail to have some effect on public opinion.

Chemistry, Inorganic and Organic. By CHARLES LOUDON BLOXAM. 6th ed. Philadelphia, Blakiston. 8°. $4.50.

THE appearance of the sixth edition of Professor Bloxam's well-known work follows closely upon the announcement of the death of the author. The general character of the work, its elaborate display of experiment, and practical intent, are the same as in previous editions; but much of the text has been re-written, and the whole revised and passed through the press under the author's own supervision. Much new matter has been incorporated (some of date even so late as the recent isolation of fluorine), and the part which deals with organic chemistry has been recast with a view to bringing theoretical relations more clearly to light. The technological applications of organic chemistry receive considerable attention, and the subject of explosives. In the previous editions, the work has been a favorite, particularly with practical men and students of applied chemistry. The present edition is an improvement upon its predecessors, and a fitting memorial of its lamented author.

Benjamin Franklin as a Man of Letters. By JOHN BACH MCMASTER. Boston, Houghton, Mifflin, & Co. 16°. $1.25.

FRANKLIN'S name has always stood side by side with that of Washington; and there are no other Americans, except perhaps Lincoln and Grant, whose deeds and character are equally well known to the mass of their countrymen. But Franklin's greatness was chiefly in the fields of politics and science, and it is chiefly as politician and scientist that he is generally known; while his strictly literary works, except the autobiography, are much less read than those of many men who, on the whole, are his inferiors. Yet his literary merits are not slight, and the influence of his writings on the opinions and tastes of his contemporaries was great. He was not only the author of the autobiography and of several scientific papers, but he was also the first great American journalist; and in all these capacities he deserves grateful remembrance. It was necessary, therefore, that in a series of works devoted to American men of letters he should have a prominent place, and the sketch of his literary work which Mr. McMaster has written is in most respects worthy of its theme. It gives, perhaps, too little space to the political papers which Franklin wrote so abundantly, and which often had great influence on public opinion and on the course of events. Many paragraphs, too, of Mr. McMaster's work are filled with mere lists of articles that Franklin wrote; and these passages could well have been spared in favor of something more important. Nor do we find so good an account of the development of Franklin's mind and character as we could have wished. Yet, in spite of these defects, the book gives an interesting account of Franklin's writings, with a mass of details relating to his life, his business, his associates, and, in short, every thing connected with his literary work. The result is a work which, as an account of Franklin's place in literature, is not likely to be surpassed.

Franklin's career has always been an example and an incentive to boys and young men that have had to struggle upward from humble beginnings, and deservedly so; for, considering the times in which he lived, his success in politics and science and literature, as well as in acquiring a fortune, was indeed surprising. Mr. McMaster, however, agrees with all other good judges, that Franklin's morality was not of a high order, and that in this respect his life and his philosophy are not what might be wished. "His philosophy," our author remarks, "was the philosophy of the useful; the philosophy whose aim it is to increase the power, to ameliorate the condition, to supply the vulgar wants, of mankind. . . . Morality he never taught, and he was not fit to teach it" (pp. 277, 278). With regard to his electrical discoveries, Mr. McMaster expresses the opinion that Franklin was considerably indebted for valuable hints to his friend Ebenezer Kinnersley; but he does not specify the particular contributions that Kinnersley made to the subject. The author points out, too, in another place, that the plan for a union of the Colonies, which Franklin proposed at Albany at the beginning of the French and Indian war, was borrowed from Daniel Coxe, who had proposed the same plan many years before, when Franklin was a boy. Mr. McMaster's judgment on Franklin considered as a writer only is likely to be generally accepted, and is in brief as follows: "The place to be allotted Franklin among American men of letters is hard to determine. He founded no school of literature. He gave no impetus to letters. He put his name to no great work of history, of poetry, of fiction. Till after his day no such thing as American literature existed. . . . His place is among that giant race of pamphleteers and essayists most of whom went before, but a few of whom came immediately after, the war for independence. And among them he is easily first" (pp. 272, 273).

A Text-Book of Inorganic Chemistry. By VICTOR VON RICHTER. Tr. by Edgar F. Smith. Philadelphia, Blakiston. 12°. $2.

IT is not surprising, however much to be deprecated, that the elementary literature of branches of knowledge like chemistry, which, constantly expanding, are frequently brought to public notice, and so made attractive to the popular imagination, should be perennially deluged by the products of the misguided passion for authorship; nor ought it to be unexpected that the great majority of the many text-books of chemistry, general and applied, which come to the light, should shortly disappear utterly from the notice of an intelligent public. The occasional varying of the usual monotony by the appearance of a work of real value to student and instructor, which proves its claim to appreciation by survival in the competition with its fellows, is refreshing. Richter's text-books are of this sort, and the volume before us represents the third American edition, based upon the fifth edition of the German original.

The scheme of development follows the order of the 'periodic law,' and the introduction of theory is gradual and opportune. Thus the reader is brought directly into contact with the laws of definite and multiple proportions and the conception of atoms and molecules only when the demonstration of the properties of the halogens leads to the point. So, also, the questions of valence and structure wait the presentation of facts with sufficient fulness to show the necessity and worth of the hypotheses advanced. Throughout the inductive method of thought is predominant; but whether the impression left upon the mind of the average student by the disconnected introduction of principles is broad and clear, may be questionable, though the threads are, at least, left in such relation that they may be easily gathered up and properly interwoven.

Thermochemical phenomena claim very considerable attention from the outset, and re-actions are discussed in the light of the law of maximum work. Sometimes, indeed, as it seems, this principle is forced beyond its depth, and phenomena are made to appear as effects of an unvarying law, rather than as illustrations of a principle which has come to be regarded as of by no means universal application. In the main, the spirit of the book is scientific. It is full and minute in the description of processes and facts, well abreast with the times, and for the most part logical and clear, though occasional crudities in the use of English, and now and then an actual lapse from grammatical accuracy, mar, without excuse in a third edition, the general effect. Such faults, though rather less numerous than in the second edition, are particularly noticeable just where they are most undesirable, — in the passages which deal with theories and principles, — and are to be credited largely to the tendency of the translator to cling to the literal rendering of the original rather than strive for an intelligible version. We note with mingled feelings the slight — too slight — improvement over the second edition in the matter of the plate of spectra.

Woman and the Commonwealth. By GEORGE PELLEW. Boston, Houghton, Mifflin, & Co. 8°. 25 cents.

THE pamphlet here before us is a plea for woman suffrage; but we doubt if it will have much influence in promoting its object. The author is so violent a partisan, and so governed by sentiment, that what he says is more likely to repel than attract those whom he wishes to convert. He goes so far as to declare that women are superior to men, both intellectually and morally, and holds that woman's influence in politics would be both purifying and elevating. He examines some of the arguments that have been adduced on the other side, and answers some of them very conclusively; but his reply to others can hardly be considered satisfactory. Moreover, he does not notice what is to many men the chief objection to woman suffrage; namely, the danger that women would be liable to use their political power to enact moral reforms by law, to the great detriment of politics and of morality. There are good things in the pamphlet, however, and those who already agree with its views will doubtless take pleasure in reading it.

NOTES AND NEWS.

THE first number of *The American Anthropologist* has just been issued. It is highly gratifying to record the establishment of a journal of this scope and character, as it is a sure sign of the growing interest in anthropology. The Anthropological Society of Washington, under whose auspices the journal is published, must be congratulated in its new enterprise, which will be highly welcomed by all students of the science of man. The papers contained in the first number show that the journal will embrace all the numerous branches of anthropology. Dr. James C. Welling contributes an inquiry into the law of Malthus; and it is significant of the Washington school of anthropologists that the first paper is devoted to a study in sociology. Col. F. A. Seely, who has so successfully applied the methods used by the Patent Office for tracing inventions to ethnological questions, gives a review of the development of time-keeping in Greece and Rome. Dr. Frank Baker's 'Anthropological Notes on the Human Hand' deals not only with the physiognomy of the hand, but also with current and ancient beliefs referring to the hand. The last paper of the number is a study of the Chane-abal tribe and dialect of Chiapas, by Dr. D. G. Brinton, in which the learned author compares the extant relics of that language, and gives it its proper place among the Maya dialects. Among the articles promised for future numbers, we notice papers by Maj. J. W. Powell, 'From Barbarism to Civilization;' H. H. Bates, 'Discontinuities in Nature's Methods;' and Dr. A. B. Meyer, 'The Nephrite Question.'

— A despatch from Zanzibar says that messengers from Emin Pacha who passed Uganda on Nov. 17 had no news whatever from Stanley, and that no news of his approach had been received in Wadelai. Further, it is stated in the telegram that King Mwanga has taken a friendly attitude towards Europeans. As Wadelai is only twelve days distant from Uganda, it appears that Stanley had not reached Emin's province in the middle of October. The next mail from the Kongo, which is due towards the end of this month, will probably bring some information regarding the events at Stanley Falls and at the mouth of the Aruvimi, which must have been of some influence upon Stanley's expedition. It seems unnecessary, so far, to entertain serious apprehensions as to his safety.

— "A large circle of admirers, both English and American," says the *Pall Mall Gazette*, "will see with pleasure that the Murchison medal of the Geological Society is to be conferred this year on Dr. J. S. Newberry of New York, the well-known professor of Columbia College. Dr. Newberry, however, has been in his time active, and indeed distinguished, in other matters besides geology. 'I remember,' writes a correspondent, 'meeting him by chance in Nashville in November, 1863, when he was at the head of the Western department of the Sanitary Commission, — an immense organization whose business it was to dispense, for the benefit of the soldiers of the Republic, great quantities of stores, consisting mainly of medicines, clothing, and comforts of all sorts, subscribed by enthusiastic citizens of the Northern States. Dr. Newberry took me down with him from Nashville to the then seat of war, on the boundary of Georgia, and I can bear witness to the workmanlike manner in which he administered his department, and the devotion with which he was regarded by all his assistants."

LETTERS TO THE EDITOR.

Errors in 'The Ancient Monuments of the Mississippi Valley.'

IT is an ungracious task to criticise at this late day the work of Messrs. Squier and Davis, which has so long been received as the standard on North American archæology; nevertheless I believe the result will be accepted as a sufficient justification for the attempt.

It is stated in the text (p. 68), under the heading 'The Newark Works,' that the circular structure E "is not, as has been generally represented, a true circle; its form is that of an ellipse, its diameters being twelve hundred and fifty feet and eleven hundred and fifty feet respectively. . . . The area of the enclosure is something over thirty acres."

A short calculation will make it evident that an ellipse having the diameters given above will enclose only twenty-six acres. We also notice, that, notwithstanding the authors' statement in the text, their plate (XXV.), which is copied from Colonel Whittlesey's survey, makes the shorter diameter (Section C–D), 1,200 feet.

A careful resurvey by the agents of the Bureau of Ethnology makes the diameters 1,205 and 1,197 feet, the latter differing but three feet from Colonel Whittlesey's measurement. The figure is therefore very nearly a true circle, the difference between the diameters being only eight feet, instead of one hundred as given by Squier and Davis.

They also state that the circular enclosure F, which connects with the Octagon, "is a true circle two thousand eight hundred and eighty feet, or upwards of half a mile, in circumference." This gives a diameter of but 917 feet, while the section A–B of the plate makes it 1,050 feet, — measuring from the gateway to the observatory, — a difference of one hundred and thirty-three feet between the text and plate. According to the survey made by the agents of the bureau, this diameter is 1,058 feet, and the one transverse to it 1,054 feet; the figure varying, in fact, but little from a true circle.

It appears from these facts that the authors, although adopting Colonel Whittlesey's survey in their plate, have differed from it in their text without a word of explanation, the variation in each case being a blunder on their part.

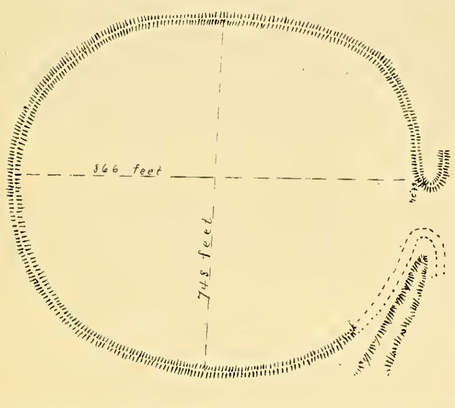
The area of the Octagon, as shown by the resurvey, is but a small fraction over thirty-six acres, including the inner halves of the walls; whereas it is given on the plate as fifty acres, and in the text as "something over fifty acres."

It is apparent that these mistakes cannot be attributed to typographical errors or mere slips of the pen. We are forced, therefore, to ascribe them to unpardonable carelessness.

Turning to their Plate XX., representing the ancient works in Liberty Township, Ross County, we find in a supplementary plan (*A*), a diagram showing their method of surveying circles, of which an explanation is given in a footnote on p. 57. In this note the authors say, "To put at once all scepticism at rest, which might otherwise arise as to the regularity of these works, it should be stated that they were all carefully surveyed by the authors in person." After mentioning their method, they add, "The supplementary plan *A* indicates the method of survey, the 'Field-Book' of which, the circle being thirty-six hundred feet in circumference, and the stations three hundred feet apart, is as follows," etc.

It is certainly disappointing, after this positive assurance of accuracy in their work, and reference to the 'Field-Book,' to find that the circle used in this illustration of their method is purely an imaginary one, as there is no circular enclosure of the dimensions given, either figured or mentioned in their book.

Another reason for being disappointed where such precision is predicated is the fact, ascertained by examination of the works, that



this plate is turned one-quarter round, the left of the page being north instead of the top. Moreover, this error is carried into the plat; the direction of the wall of the square marked 'N. 45 E.' being in truth S. 45 E., and of that marked 'N. 45 W.' being N. 45 E: in other words, the large circle is south of the square, and not east of it as represented in the plate.

A resurvey of the smaller circular enclosure, the only one of the group remaining, proves that it is far from being a true circle. This is clearly shown by the following list of external angles made by the successive chords with each other; or, in other words, the differences in the bearings of the successive chords. The survey was made precisely as suggested by Squier and Davis, except that the chords are each one hundred feet, thus bringing them within the length of a single chain. A gap of 343 feet is omitted, as the wall over this space is too nearly obliterated to be traced satisfactorily.

21° 35′	4° 45′	17° 37′	14° 43′	13° 13′	7° 30′	25° 19′
3 09	10 44	11 35	13 54	17 18	2 63	19 10
20 31	17 16	18 35	19 28	15 29	5 57	12 55

The first course (from Station 1 to 2) was S. 60° W.; from 2 to 3, S. 81° 35′ W.; and so on around, making one hundred feet at each step to Station 23; from 23 to 24, S. 1° 58′ W., 30 feet; from 24 to 1, S. 23° 20′ W., 313 feet. These figures make it clear that there are sharp curves at some points, and nearly straight stretches at others. I insert here a diagram of this so-called perfect circle prepared by Mr. Middleton, who conducted the survey. It will be seen from this that not only is it irregular, but that the longer diameter is 866 feet and the shorter 748, — a difference of 108 feet.

Although there are some puzzling questions connected with these Ohio works, yet it is apparent that the mathematical accuracy of which Messrs. Squier and Davis speak is imaginary, and is based, in fact, upon hypothetical figures. But the worst feature of the case is the evidence thus brought to light of the want of care in their work, thus shaking the confidence which has hitherto been reposed in it. Their allusion to a 'Field-Book' in connection with a purely imaginary circle, is, to say the least, misleading.

CYRUS THOMAS.

Youngsville, Penn., Feb. 8.

Cat Phenomena.

A YOUNG male cat, from the first quite secluded from other associations than those of his home, exhibited great fondness for bottled Tuscan olives when first offered this fruit, eagerly eating it, and rubbing his head and rolling upon the floor where it was dropped. This is repeated on every occasion since. His appetite for olives is seemingly insatiable, and experiments show that it is not because these are salted. He is indifferent to the ordinary culinary aromatics and toilet perfumes. What aromatics are used in the 'aromatized sea-salt' said to be used in the foreign pickling of olives? None are spoken of in the California processes, which, however, include marine salt; but this can have no pertinence to cat-senses. Have others observed the appetite, and will any one who can try cats with unpickled olives, both green and ripe, report the result? The subject has bearings on animal sensation and its relations. A series of various experiments, shutting out the possibility of artificially acquired individual appetites for flavors and odors, would be interesting.

As related to other considerations, it may be mentioned that the cat above referred to, the second time it was offered meat in its early kittenhood, and with a peculiar call therewith for the first time repeated, ran to the meat. Later, after a child had several times tickled the cat's feet by reaching under the open-work weaving of a cane-seat chair on which the animal was sitting, the cat was a number of times observed to repeat the kicking and shaking of its feet on a similar chair with no such stimulus, no person being near the chair. The titillation had become speedily associated with the touch of the cane-seat itself. These facts illustrate the quick and permanent sense-associations of animals, which are the secret of the formation of instincts (along with variation of acts and Darwin's theory of the natural selection of the same), and also of many alleged novel or isolated acts that are construed as rational.

Inherited domestic instinct was shown by the same cat, when, in its early and feeble wanderings as a kitten about the room, it sought a door with signs of a desire to have it opened. From accompanying circumstances, it was inferred that this was connected with some severe lessons on the necessity of personal neatness inflicted on some unknown ancestor: at all events, it seemed to be an inherited sense-association of some kind with the door, and suggests that many so-called 'intelligent acts' may be of this character.

A fact opposed to perception as always the stimulus to instinct is every day verified by this cat, now nine months old, in his vigorous pawing of the wooden box itself and the adjacent wall, after using the dry earth in his large, shallow sanitary box. The perception of soil, rather than of hard box and wall, should alone stimulate the instinct, if such mental act is necessary. In the act of preparatory digging, the perception of soil is manifest. It is absent in the covering process, as above shown; also in the same cat's frequent attempts to cover such food as it refuses at its usual place of feeding, by scraping the oil-cloth of the floor. There is, however, perception as well as sensation in the act of this and other cats when pausing to smell around and locate anew the matter to be covered. The process of covering is the most wonderful part of the instinct, and originally must have been the last acquired: in some cases it seems to be more or less lost; in the same individual cases it is at times omitted or little fulfilled. It is purely automatic. The wonder is, how, in the wild state, it was ever of enough consequence to cats and dogs to be acquired by natural selection; and how it was of sufficient consequence to be thoroughly acquired as automatic, while at the same time it is so poorly ingrained as to habitually blunder, and even fall into much disuse, in some cases. H. W. PARKER.

Grinnell, Io., Feb. 9.

The Nutriment in Edible Fungi.

IT is a favorite theory with some that the nutritive value of many of the fungi that are used as food is almost equal to the nutritive value of meat. A recent statement by the eminent chemist of Germany, Mr. C. T. Morner, is to the effect that the total nitrogen in this class of fungi varies between 2 and 3.64 per cent in the dry material; that 41 per cent of the total nitrogen is useful in alimentation; that all the rest belongs to non-assimilable bodies; and that, notwithstanding the relatively high figures, fungi constitute a very mediocre food, since the figures relate to dry material, and fungi contain enormous quantities of water. Mr. Morner, in this connection, gives a number of tables which show the amount of the several fungi that would be required to equal a pound of beef: mushrooms, 9 pounds; *Lactarius deliciosus*, 24 pounds; chanterelle, 41 pounds; morel, 15 pounds; *Polyporus ovinus*, 67 pounds.

Some recent experiments at the agricultural experiment station of the State of New York do not appear to sustain the statements of Professor Morner. A quantity of mushrooms (*Agaricus campestris*) growing in a pasture was gathered and subjected to an analysis, and the digestibility of the albuminoids determined by the pepsin method. The results were as follows:—

	Fresh Substance.	Water Free
Water	89.15	....
Ash	.85	7.80
Albuminoids	6.08	56.00
Crude fibre	.76	7.05
Nitrogen-free extract	2.27	21.83
Fat (ether extract)	.79	7.32
Total nitrogen	....	8.96
Albuminoids digested	....	84.50

The total nitrogen found in the dry substance was about 2.5 times as great as the highest figures given by the German chemist, while the digestibility placed it among the exceptionally rich nitrogenous foods. Experiments were also made with puff-balls. A very large one was found to have been broken into many fragments by careless handling. Many of the broken fragments were gathered together and taken for analysis. This specimen was in fine edible maturity. Another fresh one, a fine large specimen of *Lycoperdon giganteum*, was examined. The following measurements were taken in connection with the analysis: greatest diameter, 12.5 inches; height, 7.5 inches; horizontal circumference, 37.25 inches; vertical circumference, 33.5 inches; weight, 2,864 grams, or 6.35 pounds. The puff-ball was kept until the following morning before examination, when it was found to have lost 5.93 per cent by weight. A slice from the centre was taken for analysis. This contained 92.18 per cent of water. In the following table, No. 1 refers to the whole puff-ball, which was larger and more mature than No. 2, the broken one.

	No. 1.		No. 2.
	Fresh Substance.	Water Free.	Water Free.
Water	92.18	....	....
Ash	.58	7.47	6.97
Albuminoids	5.19	66.34	57.44
Crude fibre	.89	11.42	11.07
Nitrogen-free extract	1.05	13.33	22.05
Fat (ether extract)	.11	1.44	2.47
Total nitrogen	....	10.63	9.19
Per cent albuminoids digested	....	70.04	81.72

The total nitrogen for one of the puff-palls was about three times as great as the highest figures by Morner; and, even with the large percentage of water, it compares favorable in nutritive value with meat. It would seem, from the analyses which were made at the station, that Morner's specimens must have been very poor ones, or else the fungi in Germany are not so rich in albuminoids as those growing wild in the State of New York.

FREDERIC G. MATHER.

Albany, N.Y., Feb. 14.

A Worm in a Hen's Egg.

ON Sunday, Feb. 12, 1888, a lady in this city, on opening the egg of an ordinary hen, observed a worm lying coiled in the albumen or 'white' of the egg, near the lesser or pointed end. She placed the egg in a saucer, and the albumen flowed out through the opening in the shell, carrying the worm with it. After exhibiting to friends during the day, it was brought to me, Feb. 12. Upon examination, I find it to be an *Ascaris lumbricoides* about four inches in length; and, with the statement verified, the phenomenon becomes interesting in many ways.

G. C. ASHMUN.

Cleveland, O., Feb. 14.

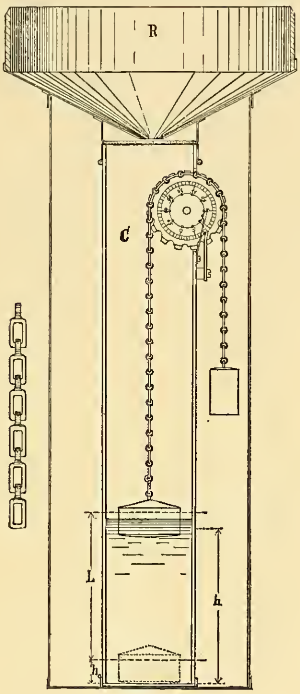
Self-Recording Rain-Gauge.

THIS recording mechanism is designed to be attached directly to the Signal Service standard gauge, now in such general use at all regular stations, and also at nearly all volunteer stations.

The figure is a sectional elevation of the gauge with the recording devices in position. The rain is received in the cylindrical part *R*, and is conducted by means of the funnel-shaped bottom into the inner tube or tall cylinder, which is made of drawn brass tubing, accurately sized, so that its sectional area is just one-tenth that of the receiver *R*, thus magnifying the rainfall tenfold. *R* is made eight inches in diameter, and the brass tube is twenty inches high, and holds two inches of rainfall, any in excess of this quantity overflowing into the outer cylinder, where it is retained and subsequently measured.

The recording mechanism needs little explanation. Definite, positive rotation of the dial-wheel in response to movements of the float is secured by use of the sprocket wheel and chain. A few links of the latter in enlarged view are shown on the left. The sprocket-wheel is graduated into divisions, each corresponding to a hundredth of an inch of rainfall. At intervals of every five divisions the wheel is set with small pins, which, when the wheel revolves, successively deflect a feeble spring, and momentarily close an electric circuit, thus recording successive five-hundredths of an inch of rainfall. The record is made in precisely the same manner as that in which the wind-velocity is now recorded at all signal service stations. Wires from the rain-gauge lead to a battery and an electromagnet which operates an armature provided with a pen or pencil that traces a line on a sheet of paper wound on a cylinder slowly revolved by clock-work. When the electric circuit is closed, the pen is drawn aside, and makes a small notch in the line, each notch representing five-hundredths of an inch of rainfall.

Although the chain is quite light, weighing but a few grams per foot, yet its weight cannot be neglected, modifying, as it does, the conditions of equilibrium between the float and counterpoise. Thus, imagine the gauge to be empty, and the float resting on the bottom. It is evident that a certain quantity of water must be added before the float will begin to be lifted on the water. This condition is indicated in the figure by the dotted lines, and with the height of the water marked h_0. In order to properly include in the measurement this quantity of water, which must be added before the float just begins to be lifted, the graduated disk, which for this purpose is made adjustable on the sprocket-wheel, is set, not with its zero-line to the index-point, but with some other line, — a line corresponding in its value to the quantity of water required to just support the float when at the bottom of the gauge. Allowance is thus made once for all, and the graduated disk, with its pins, firmly and finally attached to the body of the wheel. Now, as more water is added, the float rises. But it is observed, that, as the chain passes over the wheel, its weight is not only added to that on the counterpoise side, but is also subtracted from that on the float side; so that the equilibrium is, on the one hand, disturbed by twice the weight of the chain passing over the wheel, and, on the other hand, is restored by the rise of the float itself in the water. It follows, therefore, that the float gradually rides higher and higher on the water as more and more chain passes over the wheel. All mechanical arrangements of fusee or other expedient to secure uniform flotation are entirely unnecessary, since the variable flotation in this case follows a well-defined linear law, and is perfectly compensated for by a proper choice of the diameter of the wheel taken in connection with the number of divisions into which it is graduated; that is, we do not make the divisions on the disk to correspond to the amount of chain passing over the wheel, but to the actual rise of water in the tube, regardless of what the former may have been. However, since we wish to record each five-hundredth of an inch of rainfall, the rise of water in the tube necessary to cause the wheel to make



just one revolution must be some multiple of five-tenths of an inch, as the pins in the graduated disk must be equally distant throughout, and five-tenths of an inch of water in the tube correspond to five-hundredths of an inch of rainfall.

Moreover, the outer circumference of the wheel must likewise be some multiple of the length of the links of the chain in order that the teeth may be equally distant. The dimensions of the wheel and other parts to fit any particular chain are therefore chosen under certain limitations, but are easily found as follows: —

Let D = the diameter of the tube C.
" d = " " " " float.
" w = weight of unit length of chain.
" w' = " " " volume of water.
" R = radius of the wheel on its pitch line.
" m = number of pins to be placed in the wheel.
" n = " " teeth in wheel.
" l = length of links of chain from centre to centre.
" h_0 = depth of water when float is just supported at bottom.
" h = any depth of water to be measured.
" L = length of chain passing over wheel while the float rises on this water.
" h' = amount the float rises out of the water in coming to this position.

In its upper position the float displaces less water than when just supported at the bottom, the difference being a volume,

$$\frac{\pi d^2}{4} h',$$

and the weight of this volume is equal to twice the weight of chain passing over the wheel in reaching its upper position, or

$$\frac{\pi d^2}{4} w'h' = 2wL, \text{ and } h' = \frac{8wL}{\pi d^2 w'}:$$

hence, while the float has risen a distance L, the surface of the water has risen a distance $L-h'$, and its height from the bottom of the tube is $L-h'+h_0$; but the gauge is so made that the true rainfall is measured not from the surface around the float, but from the surface the water would assume were the float entirely removed.

The volume of water occupying the annular space around the float is

$$\frac{\pi}{4}(D^2-d^2)(h_0-h').$$

When the float is removed, this volume may be considered as spreading itself out in a layer of thickness t, given by the expression

$$\frac{\pi D^2}{4} t = \frac{\pi}{4}(D^2-d^2)(h_0-h').$$

But the former thickness of the annular volume of water was h_0-h'; hence, on removing the float, the surface of the water will fall a distance $(h_0-h')-t$, which will be found to be

$$\frac{d^2}{D^2}(h_0-h').$$

The true amount of rainfall is therefore found, after reduction, to be

$$h = L\left\{1-\frac{8w}{\pi w'}\left[\frac{1}{d^2}-\frac{1}{D^2}\right]\right\}+\frac{D^2-d^2}{D^2}h_0.$$

The last term is the amount of rainfall in true measure that must collect before the float begins to be lifted, and is the number on the graduated disk that must come opposite the index-point when the float touches the bottom of the gauge.

To find the radius of the wheel, we will consider one complete revolution and the rise of water in the tube necessary to produce this amount of motion.

For this we must have

$$0.5m = 2\pi R\left\{1-\frac{8w}{\pi w'}\left[\frac{1}{d^2}-\frac{1}{D^2}\right]\right\},$$

but $2\pi R = nl$

$$\therefore\ m = 2nl\left\{1-\frac{8w}{\pi w'}\left[\frac{1}{d^2}-\frac{1}{D^2}\right]\right\},$$

$$\text{or } m = n\left[a-\frac{b}{d^2}\right],$$

for the quantities are all known but m, n, and d.

This equation may also be written

$$d^2 = \frac{nb}{an-m},$$

and from these the value of R is found as follows: a trial value of d is assumed of approximately its desired final value. With this in the first of the last two equations, a few values of m are computed, using such consecutive values of n (the number of teeth) as would correspond to a wheel of reasonable size. In all probability, none of these values of m will be whole numbers, but some one of them will doubtless be very nearly a whole number. Taking the integral part of this and the corresponding value of n, the final value of d is computed from the last equation. With the same value of n, the radius of the wheel is given by the expression

$$R = \frac{nl}{2\pi},$$

and all the elements of the gauge are completely determined.

C. F. MARVIN.

Washington, D.C., Feb. 13.

BOOK-NOTES.

— D. C. Heath & Co. will publish, March 1, the Old English epic poem 'Judith.' It will be edited with introduction, translation, and glossary, by Prof. Albert S. Cook of the University of California, who has endeavored to adapt it to the scholar, the academic student, and the general reader.

— The Middlesex Institute, Malden, Mass., proposes to publish a flora of Middlesex County, giving a complete list of the phanerogams and vascular cryptogams. In the lower cryptogams, lists prepared by specialists will be given, as complete as the present state of knowledge permits. The issue of the work is dependent on subscription.

— An earnest and vigorous exposition, in a cheap, handy form, of the moral aspects of the international copyright question, is something that has been much needed. Such a paper has now been published by Charles Scribner's Sons of New York, in the well-known paper-covered series of this house, at a price which ought to insure for it a circulation of hundreds of thousands throughout the country. The title of the pamphlet is 'The National Sin of Literary Piracy,' and the author is the Rev. Dr. Henry Van Dyke. Dr. Van Dyke considers the subject under three phases: (1) the nature of the national sin of literary piracy, (2) its punishment, and (3) its cure. His paper is well worth reading, and ought to touch the public conscience and have its effect upon public opinion. The publishers will send any one a copy upon receipt of five cents.

— In glancing over the table of contents of *The Chautauquan* for March, one is struck with the excellence of the names. Among them are Maurice Thompson, Hjalmer Hjorth Boyesen, Pres. C. K. Adams of Cornell University, the Rev. Lyman Abbott, Lieut. Frederick Schwatka, Dr. Titus Munson Coan, Rose Hawthorne Lathrop, Mrs. Mary A. Livermore, and many others equally well known in the literary world.

— The aim of the magazine *Our Little Men and Women*, 1888 (Boston, D. Lothrop Company) is to interest children just at the time they begin to read for themselves, and lead them along for a year or two with pictures and stories and pleasant tasks, — so pleasant as to make them forget the task part altogether. *Babyland*, 1888, in general, will be about the same as in 1887.

— March 25, the New York Shakspeare Society will issue the first volume of 'The Bankside Shakspeare' on an entirely novel plan, being the text of the earliest version of each play printed in the lifetime of William Shakspeare, paralleled with the 1623 or first folio text, and both texts numbered line by line, and scrupulously collated with both the folio and quarto texts. The Bankside edition entirely disposes of the Donnelly cipher. It prints the earliest text side by side with the 1623 text, thus showing at a glance the mutations, augmentations, and curtailments which the plays underwent during their first stage life at the hands of literary pirates, stage censors, and careless printers, and in the mouths of the actors, thus rendering it at once apparent that in neither text could a cipher be found to-day by an exact mathematical process, even had one been originally concealed therein. L. L. Lawrence is clerk of the publication committee of the Shakspeare Society of New York, P.O. box 5, Newtown, Queens County, N.Y.

Calendar of Societies.

Engineers' Club, St. Louis.

Feb. 15. — O. L. Petitdidier, Practical Notes on Masonry and Stone-Laying.

Engineers' Club, Philadelphia.

Feb. 4. — A. Marichal, Rainfall.

Torrey Botanical Club, New York.

Feb. 14 — Isabel S. Arnold, Notes on the Flora of the Upper Chemung Valley; Exhibition of microscopical objects by members of the Section of Histology.

Philosophical Society, Washington.

Feb. 18. — H. H. Bates, Increasing Industrial Employment of the Rarer Metals; F. W. Clarke, The Determination of Atomic Weights; A. W. Greely, Trans-Mississippi Rainfall; J. W. Spencer, Notes on the Drift North of Lake Ontario; William Hallock, Note on the Formation of Alloys.

Feb. 22. — G. W. Hill, On the Interior Constitution of the Earth as respects Density; H. A. Hazen, A Failure in the Application of the Law of Probabilities.

Publications received at Editor's Office, Feb. 13-18

BLOXAM, C. L. Chemistry, Inorganic and Organic. 6th ed. Philadelphia, Blakiston. 788 p. 8°. $4.50.
BUREAU OF EDUCATION. Report of the Commissioner of Education for the Year 1885-86. Washington, Government. 792 p. 8°.
CORNELL University Register, The, 1887-88. Ithaca, N. Y., Cornell Univ. 216 p. 12°.
DANMAR, W. The Tail of the Earth; or, The Location and Condition of the "Spirit World." Brooklyn, The Author. 60 p. 8°. 25 cents.
GIBSON, J. Chips from the Earth's Crust; or, Short Studies in Natural Science. New York, T. Nelson & Sons. 304 p. 16°. $1.25.
——— Great Waterfalls, Cataracts, and Geysers. New York, T. Nelson & Sons. 288 p. 16°. $1.25.
MONTEITH, J. Familiar Animals and their Wild Kindred. Cincinnati, Van Antwerp, Bragg, & Co. 208 p. 16°.
SEIDEL, R. Industrial Instruction: a Pedagogic and Social Necessity. Tr. by Margaret K. Smith. Boston, Heath. 170 p. 12°. 80 cents.
SLATER, J W. Sewage Treatment, Purification and Utilization. New York, Van Nostrand. 271 p. 12°.
STEWART, B., and GEE, W. W. H. Practical Physics. Vol. I. Electricity and Magnetism. New York, Macmillan. 221 p. 16°. 60 cents.
VAN DYKE, H. The National Sin of Literary Piracy. New York, Scribner. 23 p. 16°. 5 cents.
WEST, Mary Allen. Childhood: its Care and Culture. Chicago. Woman's Temp. Publ. Assoc 772 p. 8°.
WHAT Shall we Talk About? or, Things that Every One ought to know. New York, T. Nelson & Sons. 320 p. 16°. $1.
WOODWARD, C. M. The Manual Training School. Boston, Heath. 374 p. 8°. $2.

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SCIENCE

FRIDAY, MARCH 2, 1888.

AT THE LAST MEETING of the Washington Philosophical Society, Mr. William Hallock presented a very noteworthy communication upon the formation of fusible alloys. Wood's alloy, which melts at about 64° C., is composed of lead, tin, cadmium, and bismuth, and the lowest melting-point among its constituents is 230° C. Mr. Hallock finds, however, that when the several metals are mixed together in filings, and exposed for twenty-four hours to the heat of an ordinary water-bath, the alloy is produced, and the mass becomes fluid. So, also, when freshly cut slices of sodium and potassium are simply pressed together at ordinary temperatures, liquefaction at once begins, and the fluid alloy is formed. In brief, it seems probable that the phenomena may be generalized, and that all fusible alloys may be obtained from their solid constituents at temperatures very slightly in excess of the melting-points of the compounds. Previous fluidity of either constituent is not necessary. It will be seen that these results bear directly upon the work reported by Spring, who claimed to obtain fusible alloys by pressure alone, but who neglected to prove that the temperature of his materials never at any point reached 70° C. Probably, also, Mr. Hallock's discovery may have decided bearing upon certain questions of molecular dynamics. His results are extraordinary, but it is more extraordinary that the phenomena had escaped notice hitherto.

A WRITER on the psychology of acting, in *Longman's Magazine*, has introduced the inductive method into the solution of problems connected with the histrionic art. The question has often been debated, whether the effective personation of a part requires a real experience of the emotions concerned, so that it is acting only in the sense of artificially exciting a series of emotions; or whether the whole performance is a piece of art, with the emotions, or what to the audience shall stand for such, as entirely assumed as is the costume. The writer in question has addressed a circular upon this and allied topics to members of the actor's profession, and the majority of his answers decide in favor of the real emotion. The emotion of grief is taken as the typical one; and here the sad expression is, as a rule, not put on, but is the counterpart of a real sympathetic state. Real tears flow, often to the extent of interfering with distinct articulation; nor can the impression be at once shaken off upon leaving the stage. A pertinent instance is cited of an actor and an actress having to perform a touching scene many scores of times, and each night resolving 'not to make fools of themselves' by sobs and tears; but each night they broke down, and showed the reality of their emotions. Another actress is reported as saying that if she could play whatever piece most suited her humor each evening, her task would be a much easier one. The general verdict is, that the greatest success is produced by a real emotion. If one regards the performances of persons in the hypnotic condition as 'acting' in this sense, this is precisely the conclusion that the psychologist would expect. It is, however, not a universal experience, some actors testifying that their performance is almost entirely a planned, cool, intellectual artifice; nor are such actors absent among the 'stars' of the profession. That the assumption of a *rôle* can by repetition become sufficiently assimilated to be taken up by the automatic self, is shown by the experience of a very celebrated actress, who played the 'potion scene' in 'Romeo and Juliet' without knowing it, and could only with the greatest difficulty be prevented from playing the scene over again, so confident was she that she had not played it.

THE COMMITTEE on the geology of Rhode Island of the Providence Franklin Society has issued a valuable report on the geology of Rhode Island, including a useful bibliography of this subject, and setting forth briefly the various attempts made by the society to organize a thorough topographical and geological survey of the State. The committee was appointed in 1883, and we quote from its valuable report the following general remarks, which show the object of the work undertaken by the committee: "Our chief purpose has been to bring to the notice of the Franklin Society what has already been learned about the geology of Rhode Island. We have attempted little original investigation, but have tried to lay the foundations essential to future progress. The necessity for a collation of authorities is apparent to one who seeks to gain a clear idea of the geology of Rhode Island. Information is scattered through many publications. The Franklin Society endeavored to secure a new survey of the State in 1875–76, and again made an effort for a topographical survey in 1885–86; but thus far nothing has been accomplished. This report is published as the best contribution the society can make to the cause, — a step towards a complete survey; for a knowledge of what has already been learned is the proper foundation on which to build." It is to be hoped that the unceasing endeavors of the society to undertake a survey on a similar plan to that of Massachusetts, in co-operation with the United States Geological Survey, will be successful. In 1885 Governor Brown sent a message to the Assembly, commending such a plan, which involved two annual payments of three thousand dollars, but the Assembly did not act on it. The present publication, which is a valuable help to all students of the subject of the geology and geography of New England, we hope will help to show the necessity of undertaking a thorough survey.

IS THE RAINFALL INCREASING UPON THE PLAINS?

To most of the inhabitants of that broad, billowy expanse which stretches from the Missouri to the Rocky Mountains, and from Canada to the Rio Grande, this question may seem unnecessary. It has so long been assumed by them as an axiom that the rainfall is increasing, that the opening of the question to discussion may appear like questioning the Copernican system. They have seen the frontier of settlement moving steadily westward, passing successively the limits set for it. Thirty years ago all the country west of the Missouri was considered as the 'Great American Desert,' in which, without irrigation, agriculture was an impossibility. But the stream of immigration has swept, with each succeeding year, farther and farther up the slope of the plains, driving the border of the desert before it. The 98th meridian was set as the boundary which the farmer could not pass, but now millions of acres are under cultivation beyond it; then the 100th meridian, but in Kansas and Nebraska the farms stretch scores of miles farther westward.

Progress has not, however, been uniform. Seasons of drought have checked it, and have depopulated temporarily large areas; but the settlers have returned to the charge, and have invariably won the day in the end.

To-day the cereals are being cultivated in Kansas, without irrigation, nearly to the west boundary of the State, in regions where the annual rainfall twenty years ago was less than twenty inches, — a region which at that time, as was generally agreed, could be rendered productive only by artificial watering. How has this been brought about? Have settlement and tree-planting induced greater rainfall, as is almost universally believed in this region, or are other causes involved?

Of course, if this westward extension of settlement has become possible through an increase of rainfall, such increase must be of notable amount. The effect upon agriculture of a minute increase would be scarcely appreciable, and certainly would not suffice to produce the effects claimed for it, or to explain the wide-spread belief in this increase which is prevalent. In examining the rainfall records, we are, then, to look for substantial amounts of increase, — several inches annually. I would add that these records are now ample for testing this theory, and their testimony should be conclusive.

I find in this area twenty-six stations at which rainfall records have been kept for periods ranging from six to twenty-eight years, the total number of years of record being three hundred and ten. These stations are scattered widely over the area in question, from its eastern to its western border, and involve all stages of settlement. Now, if there has occurred an increase in the amount of rainfall, that of the later years of any series should, on the whole, be greater than that of the earlier years. I have therefore cut each of these series in the middle, and added up the rainfall of each half. These are presented in the following table, where the first column gives the names of the stations; the second, the number of years in the series; the third and fourth, the total rainfall in the first and second halves of each series respectively; and the fifth, the increase or decrease, the former being distinguished by the +, the latter by the — sign: —

Fort Leavenworth, Kan	28	518	525	+ 7
Leavenworth, Kan.	18	366	362	— 4
Manhattan, Kan	28	400	407	+ 7
Lawrence, Kan	18	306	319	+ 13
Fort Larned, Kan	12	131	119	— 12
Topeka, Kan	8	117	140	+ 23
Dodge City, Kan	12	105	149	+ 44
Wallace, Kan	6	50	59	+ 9
Atchison, Kan	8	189	156	— 33
Baxter Springs, Kan	6	130	102	— 28
Burlingame, Kan	6	84	96	+ 12
Council Grove, Kan	8	178	141	— 37
Fort Hays, Kan	6	55	79	+ 24
Fort Riley, Kan	16	185	214	+ 29
Olathe, Kan	8	201	194	— 7
Belleville, Kan	14	184	218	+ 34
De Soto, Neb	6	109	80	— 29
Fort McPherson, Neb	6	58	52	— 6
North Platte, Neb	12	108	120	+ 12
Omaha, Neb	18	319	337	+ 18
Omaha Agency, Neb	6	75	78	+ 3
Yankton, Dak	12	170	178	+ 8
Bismarck, Dak	12	140	102	— 38
Fort Benson, Mont	6	34	40	+ 6
Cheyenne, Wyo	16	84	98	+ 14
Denver, Col	14	112	103	— 9

It will be seen at once that the individual results are contradictory in a high degree; those from sixteen stations showing an increase, while ten stations show a decrease. These contradictions, which are due to the irregularity of the rainfall may, however, be in a measure eliminated by combining the results, under the supposition that the change, if any, has been a progressive one. Under this assumption, the sum of the earlier halves of the different series should be less than that of the later halves. Adding them together, it is found that the aggregate rainfall at all the stations was, in the first half of the series, 4,408 inches, and in the second half, 4,468 inches; showing that there has apparently taken place an increase of 60 inches in the total amount of rainfall at all these stations in a total of 310 years, or, to put it in another form, there has fallen in each year of the second half of these series 0.4 of an inch more rain than in the first half. It is unnecessary to add that this is not the sort of increase for which we were searching, as an increase of but a fraction of an inch certainly could not produce the results which are claimed. An examination of the seasonal distribution of the rainfall shows that that also has undergone no material change since settlement began in this region. We may therefore dismiss as baseless the popular idea of an increase in rainfall, either annual or during the growing season, and look elsewhere for an explanation of the phenomena of settlement which the plains present.

The early explorers, of the time of Fremont and the Pacific Railroad surveys, based their judgments of the capabilities of the country for agriculture upon the character of the natural products, the absence of trees, the presence only of sparse, hardy grasses, the cactus, and the yucca. Their judgment was a mistaken one, as events have amply proved.

Since their time physical geographers have set arbitrary limits to safe farming without irrigation, basing their reasoning upon the known rainfall of the region, and that supposed to be required for the average farm product. Subsequent experience has shown that a much smaller quantity of rain is essential than was supposed. To my mind, there is little more to be said. If it be found, that, with an annual rainfall during the growing season not greater than ten inches, farming can be carried on successfully, the only question remaining is, how the mistake could have been made of supposing that it required a greater amount.

There is no doubt that cultivation adds greatly to the economy of the rainfall. The surface of the plains in an uncultivated condition is mainly bare, hard ground, but slightly protected by its covering of grasses. From such a surface the rain flows off freely, and an unusually large proportion of it finds its way into the streams, while a correspondingly small proportion sinks into the ground. The farmer, with plough and harrow, changes all this, and retains in the soil most of the rainfall. From year to year the supply in the soil increases, so that the subsoil becomes in time a reservoir from which the surface soil may draw in times of drought. Furthermore, the scanty vegetation offers little protection against evaporation, which is excessive upon the barren plains; but the ampler mantle which cultivation spreads over the soil prevents its moisture from disappearing in the atmosphere with so great rapidity.

How much farther westward into the arid region can the farmer push? This is a very important question, affecting the value of millions of acres of land; for, if this land can be cultivated only by the aid of irrigation, nine-tenths of eastern Montana, Wyoming, Colorado, and New Mexico, together with western Dakota, Nebraska, and Texas, must be given over to the cattle-men in perpetuity, as the streams are entirely insufficient for irrigation. A conclusive and satisfactory answer can be given only by the farmer

HENRY GANNETT.

WASHINGTON SCIENTIFIC NEWS.

A Novel Way of Forming Alloys. — The Constituents of Sugar. — Rainfall in the Arid Regions. — Irish Myths and Folk-Tales. — Examining Fats.

The Formation of Alloys.

THE following is an abstract of a note read before the Philosophical Society by William Hallock, of the United States Geological Survey, Feb. 18, 1888: —

In the *Berichte der chemischen Gesellschaft*, vol. xv. 1882, pp. 595–597, W. Spring describes the formation of alloys by submitting the filings of the constituent metals to high pressure, without appreciable rise in temperature. Wood's alloy of cadmium, tin, lead, and bismuth he produced by mixing proper weights of the filings of these metals, and subjecting them to a pressure of 7,000 atmospheres. The block thus obtained was again filed up, and subjected to the same pressure.

In this way a block of metal was produced which possessed the physical properties of ordinary Wood's alloy, formed by melting the mixed constituents.

W. Chandler Roberts repeated this experiment (*Chemical News*, vol. xlv. 1882, p. 231), and verified Mr. Spring's results.

In seeking an explanation of the above phenomenon satisfactory to myself, I reasoned, that if at any time during the first compression, the subsequent filing, or the second compression, anywhere throughout the mass, the constituent metals were in contact, at that point there would be a minute globule of the alloy, — a molecule of alloy, as it were. If, now, the temperature of the block, either during compression or subsequently, be raised to 70° C., then that molecule of alloy will fuse, and act as a solvent upon the surrounding metals till the whole mass is fused.

If my idea was correct, I concluded that perhaps I could produce the result without pressure, giving more time and an appropriate temperature to the substance.

The filed metals in the proper proportions were mixed, and packed into the bottom of a 'sealed tube,' such as is used for blowpipe work, using no greater pressure than could be conveniently exerted with a piece of wire, one-eighth of an inch in diameter, held between the thumb and finger. This tube was hung in the water-bath of the laboratory over night (eighteen hours), thus maintaining it at a temperature of from 98° to 100° C. On examination, the filings had settled down considerably. The tube was then struck upon the table, jarring them down still more, and in an hour or two the whole was a molten globule. The experiment was repeated, using larger quantities packed in with a lead-pencil, and occasionally pressing the mass together with the pencil, producing twenty or thirty grains of alloy. Since then, tin and lead have been fused together at 200° C., tin melting only at 230° C.; also sodium and potassium at ordinary temperatures (20° C.), the first melting at about 90° C., and the latter at about 60° C. Thus I proposed the law, that *an alloy can be formed out of the constituents at a temperature above the melting-point of the alloy, although it be far below that of any constituent, with no (appreciable) pressure.* The extended verification of this law, as well as the electrical and thermal phenomena associated therewith, will be the subject of a work which I hope soon to undertake and carry through.

The Chemistry of Sugar.

The following is an abstract of some remarks made by Prof. H. W. Wiley, of the Agricultural Department, at the meeting of the Chemical Society, held Feb. 9. Referring to his recent work in Louisiana, he said, "When the cane is subjected to pressure analysis, it is found that the juice differs from that in the ordinary bagasse. There are two kinds of juice in the cane, — one stored in the cells, and the other in the circulation. The juice oozing from the end of the cane, at first, from compression, is like water, and has no sugar, so far as the taste goes." Another subject of investigation had to do with the determination of the total solids in the juices, which is a difficult problem. It was fully demonstrated that the saccharometers in use are not reliable, because they are mostly graduated to pure sugar solutions, while in the cane juices there is a mixture of various solutions. Professor Wiley described the process he used of drying to obtain the total solids, and his method of determining them by the addition of alcohol and the use of paper coils. He also said, in regard to the genesis of sucrose, that it had been proved beyond doubt that it is a direct formation, and not a secondary product. All the facts are against the old theory that starch is formed first, and the sugar from it. The sugar in the circulatory sap is never a starch sugar, and cannot have come from starch. It is found in the leaf, and is formed by the aid of chlorophyl. He also described the polarizing instrument, and said that many improvements have been made in it. Another point developed is that the amount of available sugar in the cane is greater than it has heretofore been supposed to be. In closing, he said that many of these points had been indicated in his previous work, but were emphasized by his recent investigations.

Rainfall beyond the Mississippi.

Gen. A. W. Greely, chief signal officer, gave to the Washington Philosophical Society, at its regular meeting, Feb. 18, the partial results of a study he is now engaged upon of the rainfall in the trans-Mississippi region. He had before him a number of maps upon which had been charted the observations which were the basis of his study, and referred to them constantly as he spoke. He said that the idea that there is any part of the West that is absolutely rainless is now a banished myth. During the past ten years the number of stations for observation has been doubled, so that there are, in twelve States and Territories, nearly one hundred stations; and the observations, if reduced to a single one, would cover a period of nearly five thousand years. The result of charting these observations has been to reduce very greatly the areas of small rainfall. The area in which the annual precipitation was supposed to be less than five inches has almost disappeared, and that in which the rainfall was put down at less than fifteen inches has been reduced by a quarter of a million of square miles since the Census map of 1880 was made.

General Greely discussed the question of what constitutes an arid region, and said that he does not agree with Maj. J. W. Powell, who placed the minimum amount of precipitation necessary for successful agriculture at twenty inches per annum. He said that millions of bushels of wheat are raised every year where the rainfall is less than twenty inches, and referred to the statistics of Dakota, where more than 2,600,000 bushels were raised in the two counties of Richland and Stutsman in 1885, and 1,500,000 in 1887, with an average rainfall of 13.7 to 15.1 inches.

General Greely also mentioned the interesting fact, that, while the rainfall increases as the rivers which flow directly into the Gulf of Mexico or into the Pacific Ocean are followed up from their mouths, it increases with the distance from the mouths of such as empty into other bodies of water, like the Colorado.

General Greely's charts also prove that much of the rainfall in what has been known as the arid region, and where it was formerly supposed that the precipitation was five inches or less, was not reported. In some of these places the actual rainfall is as much as sixteen inches, and in one it is thirty-seven. This explains why water is found so abundantly in wells in some parts of southern California, where the annual rainfall has been reported as ten, twelve, and thirteen inches: the actual precipitation is twenty-four inches.

General Greely said that he had caused to be placed upon the charts the maximum and the minimum rainfall of the various stations, not expecting that they would indicate any thing, but that the curves were almost as regular as those on the annual maps. He explained that the small average amount of rainfall formerly reported was due in part to the fact that so large a number of stations had been situated along the line of the Pacific Railroad, which, seeking low gradients, had been built through a section of country in which the precipitation was small. He spoke also of the prevalent opinion that the rainfall in the West is increasing, and said that he thinks this opinion to be correct, and closed with the remark that it was not fair to treat that country on the basis of seasonable rains, since the larger portion of the precipitation took place during different months in different sections of the region.

In the brief discussion which followed the address, Prof. G. K. Gilbert said that it was not safe to fix any given amount of rainfall as the minimum necessary for successful agriculture, without qualifications. Very much depends upon the time when the rain falls, and the rapidity with which evaporation takes place. More rain is required in Arizona than in Dakota, and many unsuccessful agricultural experiments have been made in Utah near Camp Douglass, where the annual precipitation is as much as eighteen inches.

Professor Fernow said that he had compared the amount of rainfall during the five months of vegetation, in Philadelphia, Buffalo, Dodge City, and North Platte. It ranges from fifteen to seventeen inches, the largest amount of precipitation being at North Platte. There was no lack of rainfall at the eastern stations, but at North Platte it was impossible to raise a crop. He learned also from Utah that the amount of water needed to irrigate land there was less after two or three years than when it was first turned on.

Prof. C. V. Riley spoke of the frequency and violence of the rainfall as modifying in an important degree its effect.

Folk-Lore of Ireland.

The following is an abstract of a paper read before the Anthropological Society of Washington, Feb. 12, by Jeremiah Curtin: —

For many years I have believed that there was a great stock of myths and folk-lore current among the people in Ireland, as well as an abundance of that class of facts which throw light on the history of the human mind, — facts which would be valuable to the scientific world, and highly prized by this Anthropological Society of Washington. I know that there was a large body of manuscript Gaelic literature of considerable antiquity and of high value, especially that portion of it devoted to mythology, heroic tales, chronicles, and law tracts. I hoped, also, there might still remain in the minds of the people of the remote districts of Ireland many idioms useful in explaining the language of the manuscripts, and many myths and tales that would supplement and strengthen the recorded mythology. I went to Ireland last year, therefore, for the purpose of settling this question by actual investigation, and my first step was to make the acquaintance of the few Gaelic scholars in Ireland, and examine the manuscripts preserved in Dublin.

These manuscripts fill about two thousand volumes, are kept in the Royal Irish Academy and the University of Dublin, and are of various kinds, — histories, chronicles, treatises on law, medicine, astronomy, etc. Among them, and of chief interest to me, were the manuscripts containing the myths and heroic tales of the Gaelic people. These myths and tales, if printed, would fill about ten thousand quarto pages. This is the greatest collection of myths in Europe. It is perfectly unique, both in quality and quantity. Neither in ancient nor modern times had any nation on the mainland of Europe such a collection; and O'Curry very truly said that the single 'Book of Leinster,' if published to the world, would make the reputation of any nation.

The 'Book of Leinster' is but one of many books of its class, though it is the richest of all in contents; and the 'Book of Leinster' is not yet accessible to the world, though it has, with three other volumes, been placed within the reach of a few Gaelic scholars in the form of some *facsimile* copies of the original manuscript, with all the contractions and abbreviations, of which several hundred were used by scribes in the days before printing. Some of the most important of the Gaelic manuscripts of myths and tales have come to us in unique copies, while a great many others of equal value, known by title or extract, have perished. Merely a wreck, a remnant of the old time, has been saved; but it is a wreck so extensive as to excite real wonder and thankfulness.

It is a matter of deep interest, also, to the scientific investigator, to learn that the chronicles of the country, both lay and ecclesiastical, especially the latter, bring to light a great many phases and forms of thought of pre-Christian times of which we have no record elsewhere. There is no church history in western Europe so valuable in this respect as that of the Church in Ireland; for the conversion of the people was voluntary, and the country at that time, and for some centuries later, was free from foreign pressure of every description. All of the ancient beliefs and practices that could posbly be permitted, were permitted. Some of these lived on parallel with the Church, and others were incorporated into it.

After a brief visit in Dublin, where I found assistance, and a most agreeable hospitality from the members of the Royal Irish Academy, the University of Dublin, and the two Gaelic societies, I set out to visit remote places in the west. Without entering into any detailed account, I may state that I visited some of the characteristic and secluded parts of the west coast, and took down personally a large body of myths and stories, some very long, others not so long. This collection of materials is sufficient to fill a couple of twelvemo volumes, and will give some idea of what yet remains in the Celtic mind of Ireland. It is, however, but a small part of that mental treasure still in possession of the people.

One of the largest and finest groups of Gaelic myths is the Ossianic, or myths of Fin MacCumhal and the Fenians of Erin. Fin has his immediate personal attendants. He and they possess fixed and well-determined characters, and their names and exploits are familiar to all who have heard the tales of the Fenians of Erin. There are no stories more popular, and they are interlaced with a great number of other important myths of various descriptions. Every place in the land has witnessed the activity with which Fin and his men struggled with every manner of obstacle, and fought with every kind of foe. Fin and Oisin, according to the stories, were born in a great many places in Ireland. Scotland is as full of their activity and birthplaces. Glencoe, the scene of the celebrated massacre, is a birthplace of Oisin. The account given of how these Fenian or Ossianic stories were preserved is remarkable enough. The authorship of them all is attributed to Oisin, the son of Fin MacCumhal, who told them to St. Patrick. St. Patrick had them carefully written down; but he found them so agreeable and entertaining, as well as so numerous, that he said people would neglect their work and do nothing but listen to these stories, so he destroyed two-thirds of what was told him by Oisin. From the remaining one-third come all the tales of the Fenians now current in Ireland and Scotland. In one of the stories which I collected is a complete account of how Oisin came back from Tir nan Og (the land of youth), after he had been there three hundred years, and told them to St. Patrick.

The time is coming when mythology may become a science, if scholars will work to that end, but mythology is far from being a science yet. There are many theories and loose statements current about mythology, — 'disease of language,' 'sun myths,' 'serpent myths,' etc., — but there is no science in all this. It is fancy, guesswork, efforts of men dealing with insufficient and unsatisfactory materials, collected, in many cases, by incompetent hands or by persons who tamper with materials for the purpose of improving them, or fitting them to some theory.

There is probably no more striking or interesting case of error than that of Max Müller, who has founded a whole theory of mythology on what he calls a 'disease of language.' Now, Max Müller's 'disease of language' is merely an incident in the history of mythology, instead of being, as he makes it, the great central and germinal factor, the parent instead of attendant of mythology. Müller's error is one that could never have been made by a man having proper and sufficient materials at hand from mythologies still intact. The things we need, above all, at present, to advance mythology on the way to becoming a science, are *facts*, and facts in mythology are well-preserved myths. These we need in great number, and in all the variants attainable in each linguistic stock of people.

Among the different branches of the Aryan race in Europe, there is none, as I have already stated, having so extensive and well-preserved a mythology as the people of Ireland. This mythology is to be found in two places, — in Gaelic manuscript, and in the minds of the people of the more secluded parts of the island. Only very small portions of the Gaelic manuscripts have been translated, and still smaller portions published; so that practically this body of material for science is unknown to the world. The work of utilizing it remains to be done. Now, it will be found that the manuscript material can never be properly translated and explained without a knowledge of the words and idioms of the language, as well as the ideas and myths that are in the minds of the Gaelic-speaking people of Ireland.

The Qualities of Fats.

The chemist and microscopist of the Department of Agriculture are engaged in an examination of samples of the lard of commerce, for the purpose of determining its constituents, and also of discovering the best tests for adulteration. Professor Wiley has employed all of the ordinary tests, but gets the best results from one suggested by an Italian chemist, Bechi, in which nitrate of silver is used. Cottonseed-oil, when brought in contact with nitrate of silver, reduces the latter to a metallic state. Professor Wiley has also begun an interesting series of experiments to determine the refraction of different oily substances. The instrument used is Abbé's refractometer, which shows the index of refraction upon a scale upon its side. There is no literature on this subject, and the tables which Professor Wiley proposes to make will be an interesting contribution to the present knowledge of the qualities of fats. X.

Washington, D.C., March 1.

HEALTH MATTERS.

Transmission of Infection by Rags.

THE 'Eighteenth Annual Report of the State Board of Health of Massachusetts' contains a valuable report by Dr. C. F. Withington, who was requested by the board to investigate the question of the transmission of infectious diseases by means of rags. Dr. Withington's report is very full and complete, and is a very fair and unbiassed statement of the facts as we understand them. His conclusions are as follows: —

1. Small-pox has been transmitted through the medium of rags in a certain number of cases, small in proportion to the whole number

of persons who handle rags, but absolutely numerous enough to show that unvaccinated workers in rags are exposed to an actual, if not imminent, danger of infection from this source.

2. The source of this infection is more frequently domestic than foreign rags, though the disease has been caused by the latter. This possibility of infection through imported rags accords with what is known of the tenacity of life of the variolous poison.

3. Among the rarer means whereby cholera is transmitted are textile fabrics infected with choleraic discharges. There is evidence that clothing from cholera patients, and possibly clothing merely packed in an infected locality, has, when transported to a distance and there unpacked, caused the disease in those who have handled it, thus starting a fresh cholera focus. A proper distinction exists between clothing, on the one hand, recently removed from the body, and again, not long after, put on to the body; and rags, on the other hand, which, if transported to this country, are certain to have undergone a carefully discriminative sorting and drying, and to have spent a considerable time in warehouse and on shipboard.

4. The statement that cholera has been transmitted by paper-rags rests upon a solitary case, of which the details are not complete, and on the reliability of which some of the highest authorities on cholera have cast doubt. If the case be accepted, it is one of infection by *domestic* rags, carried only fifty miles from their place of collection.

5. An epidemic affection, known as 'rag-sorters' disease,' appears to have broken out on three or four occasions in European paper-mills. It was probably, though not certainly, the disease called 'anthrax.'

6. Authenticated instances are not to be found in which the other infectious diseases — typhus and typhoid fevers, scarlet-fever, measles, and diphtheria — have been transmitted through rags; though it is to be said that such evidence, supposing the fact to exist, would be very difficult to get. Neither do the mortality tables, as shown by registration reports, show a preponderance of deaths from these diseases in the paper-making towns.

7. There is no evidence to show that rag-sorters as a class are, except for occasional cases of small-pox and a certain amount of pulmonary irritation from the dust of improperly ventilated rooms, less healthy than other persons engaged in in-door manual occupations.

8. Despite the fact that cholera is not known to have ever been conveyed to this or any other country in foreign-baled rags, it is a reasonable precaution to prohibit the landing in any United States port of rags gathered in epidemically infected localities, in view of the possibility that among such rags there may have been thrown articles of infected clothing which have not been sufficiently dried and aired, or have not occupied enough time in their transportation to be devoid of danger. Such prohibitions should be limited to the time and place of epidemic infection; but all necessary precautions should be taken to make sure that rags shipped from a healthy port were not gathered or baled in an infected place.

9. As the only safeguard against the occurrence of small-pox among operatives, paper-mill owners, whether 'incorporated companies' within the purview of the statute or not, should make evidence of successful vaccination an absolute prerequisite to the employment of any person in the mill, and a re-vaccination at regular intervals (not merely on the occurrence of an epidemic in the neighborhood) a condition of being retained in their employ.

10. As the contagion of small-pox, phthisis, and perhaps other diseases, is capable of being inspired when the particles carrying it are suspended in the air in the form of dust; and as dust, even when it carries no contagion, is irritating to the respiratory passages, — every mill should have, in connection with each table in the rag-room and in the dusting-room, a ventilating system, preferably consisting of flues connected with an exhaust-fan, so that the dust, as fast as it is disengaged, may be withdrawn from the air. The success which attends the working of such an apparatus, in some mills where it is in use, is a sufficient warrant for its general introduction.

11. A law similar to that of Great Britain (Section 125 of the Public Health Act of 1875), imposing a penalty on the selling or giving-away of infected rags from persons sick with any dangerous disease, seems desirable. Public institutions and private householders should be obliged (and not, as at present, simply advised) to insure the disinfection of the more valuable articles, and the destruction by fire of all rags, that have been thus exposed.

12. As domestic rags comprise more than half those used, and represent a still larger proportion of the infection likely to be carried, it follows that they should participate in whatever disinfection is thought necessary. This fact points to the paper-mill as the proper place for making such disinfection. The sulphur process would doubtless afford the least embarrassment to the manufacturer; the bales being opened in a tightly closed room, the rags being spread on racks, and sulphur burned in the proportion of two pounds to each one thousand cubic feet of space. The introduction of steam under pressure, the rags being similarly disposed, would be the most effective disinfection possible, but would dampen the rags to their injury, unless the moisture were dried out at once with a current of hot air.

ELECTRICAL BULLET-PROBE. — At a recent meeting of the New York Academy of Medicine, Dr. Girdner of New York exhibited his telephonic bullet-probe. The interesting feature of this probe is that it is operated by a current of electricity extracted from the body of the patient himself, in whom it is desired to locate a metallic missile. The construction of this probe is as follows: to each of the two terminals of a telephone-receiver, an insulated flexible wire about four feet long is connected. At the free end of one of these wires a hollow, bulbous piece of steel is attached. At the free end of the other wire is a suitable handle in which a probe may be placed, and held by a clamp-screw. The internal arrangement of the handle is such that a perfect electrical contact exists between the end of the probe and that of the wire which terminates in the handle: the same is true for the end of the other wire and the steel bulb. When a current of electricity is passed through the coil in the receiver by means of the bulb and the probe, each time that the current is made and broken a clicking or rasping sound is heard in the receiver held to the ear. All sounds are shut out except that heard when the bullet is touched; and the apparatus is so constructed that both hands are left free. In describing the application of this probe, Dr. Girdner mentioned a case seen in practice, in which a musket-ball had lain between the bones of the leg for twenty-two years. When an ordinary probe was passed, hard substances could be felt in many places, but it could not be told whether they were bone or bullet. The porcelain probe, invented by the distinguished French surgeon, Nélaton, was of no use, as the bullet was so covered by a thick crust of salts of lead as not to be marked when it was rubbed against the bullet. When the telephonic probe was passed, no response came so long as bone and other tissues were touched; but, the moment the probe came in contact with the bullet, a clicking and rasping sound was heard in the telephone. During this test the steel bulb was held in the patient's mouth. A more detailed description of the probe, with illustrations, may be found in the *New York Medical Record* of Feb. 4, 1888.

MEDICAL COLLEGES IN THE UNITED STATES. — The last annual report of the State Board of Health of Illinois contains some very interesting statistics in reference to medical education in the United States. Since 1886 there have been two new medical colleges established, and two have ceased to exist. There are now 114 colleges which exact an educational requirement of intending matriculates, as against 45 formerly, there being no change in this respect from the previous year; 43 colleges now exact attendance upon three or more courses of lectures, as against 22 formerly, — being a gain of two over 1886, — and 57 others make provision for a three or four years' graded course. Hygiene in now taught in 114, and medical jurisprudence in 112 colleges, as against 42 and 61 respectively prior to 1883. There is an increase in the average of lecture-terms from 23.5 weeks to 24.9 weeks during this period; and 114 colleges now have terms of five months or over, and 63 have terms of six months or over, as compared with 101 and 42 respectively. There is only one medical college that has a course less than twenty weeks, the Medical College of Georgia. In 1882–83, out of every 1,000 matriculates, 322 were graduated, taking both the United States and Canada and all schools of practice into the account. In 1886–87 only 294 out of every 1,000 matriculates were graduated. In the United States alone, in 1882–83, out of every 1,000 matriculates, 331 were graduated, while in 1886–87 only 305 out of every 1,000 matriculates were graduated.

THE FUTURE OF MEDICAL GRADUATES. — Of some one thousand graduates from collegiate institutions, says the *Pacific Record*, seventy-five only make for themselves a name and prominence in their calling. About two hundred, having business qualifications, become rich by their practice and by judicious investments. Four hundred abandon, in whole or in part, their profession for some more lucrative business; and the balance struggle with mediocre ability for a bare subsistence, and a wearying effort to keep up an appearance before the people.

ALCOHOL AND FEVERS. — Dr. Kretzschmar of Brooklyn read a paper at the recent meeting in Albany of the New York Medical Society, on the use of alcohol in certain forms of fever. He believed that in some diseases alcohol, if properly administered, was not only instrumental in prolonging life, but was frequently a most potent factor in preserving it. Alcohol possesses the qualities of both food and medicine. It is one of the best antiseptics, and the most reliable remedy we have in the treatment of diphtheria. He regarded alcohol as beneficial in the treatment of phthisis, especially when the temperature of the patient was increased. In the discussion which followed, Dr. Castle advised that stimulants be kept in several small bottles, as, when exposed to the air, they lost valuable medicinal properties.

BOVINE TUBERCULOSIS. — Dr. Brush of Mount Vernon discussed at the Albany meeting the subject of bovine tuberculosis. Of all domesticated animals, the bovines are the most subject to tuberculosis. Five per cent of the cattle in England are affected with tuberculosis, and it is said that twenty per cent of the cattle in some of the thoroughbred Jersey herds in the Northern States are similarly affected. He believed that more human beings were not infected, because the normal temperature of the human race was so much lower than that of the bovine, — 98.5°F. in the one, and 101° to 103° F. in the other; this latter temperature being necessary for the growth of the germ of the disease. The cultivation of tuberculosis in animals confirms this view, as resistance to the disease decreased as the normal temperature of the animal increased. Thus, in the dog, resistance was good, while in the common fowl it was *nil*. Dr. Brush thought that the Federal Government would do better to spend its money in the investigation and suppression of this disease, than to appropriate five hundred thousand dollars to stamp out pleuro-pneumonia, which did not affect the human race. He believed, that, if bovine tuberculosis were eradicated, it would soon become eliminated from the human race, and he thought that physicians should strive to procure laws which would accomplish this.

ELECTRICAL SCIENCE.

Secondary Batteries.

IT has been for many years the dream of inventors to perfect some apparatus by which energy could be stored, to be used when occasion required. The secondary battery accomplishes this better than any thing else that has been invented, but it has limitations and defects that it is well to point out.

The two principal uses, with a great number of minor applications, to which secondary batteries can be put at present, are the distribution of energy for electric lighting, and their use in driving street-cars. As for the first of these, it is well known that the direct system of constant potential distribution cannot be employed at any considerable distance from the central station, owing to the heavy investment in copper necessary. If storage-batteries could be economically used, however, they could be distributed at different points through the district, to be lighted and charged by a high potential current, allowing comparatively small conductors to be used, and employing the electric plant during the day, when it would otherwise be idle.

The advantages for street-car work are apparent: each car carries within itself the energy necessary for running it; a break-down of one car does not affect the rest of the system. Compared with other electrical systems, the advantages are, that it can be used in crowded streets with no danger from high potential currents; and where a large number of cars are used, it is much simpler than any other plan. Compared with cables, it gives a greater economy of power, a less first cost, and the impossibility of one accident disabling the whole line.

The disadvantages of secondary batteries are the cost, the waste of energy, the deterioration, and the weight for a given capacity and rate of discharge.

The type of storage-cell most generally in use is some modification of the Faure cell, generally of the Faure-Sellon-Volkmar type. In it the plates are made of cast lead supports or 'grids,' into which is pasted a mixture of red lead and sulphuric acid. The 'grid' has in it square hour-glass shaped holes, the contraction in the middle being intended to prevent the active material from falling out. The plates pasted with red lead are put into dilute sulphuric acid, alternate plates are connected together, and an electric current is sent between the two sets, changing them into pure lead and lead peroxide. Plates thus 'formed' are put into cells with dilute sulphuric acid, a number of lead or negative plates, and peroxide or positive plates, in each cell. This is, very briefly, the general method of manufacture.

Now, suppose we have one of these cells fully charged, — all of the positive plate peroxide, all of the negative plate lead, — and discharge it through a resistance. At first the electro-motive force is over 2 volts. This will rapidly run down to about 1.95 to 2 volts, where it will remain constant (provided we do not discharge the cell too fast) for a considerable time, when it will begin to fall, and, if we continue the discharge, it will finally become zero. If, now, the plates be analyzed, it will be found that the positive plate has in it peroxide and sulphate of lead, the latter perhaps fifteen to twenty per cent of the whole active material. The negative plate will consist of pure lead and sulphate. If we charge the cell, the plates will be changed to pure lead and peroxide again, the electro-motive force will gradually rise to 2.25 volts, and, when the charge is nearly complete, oxygen will be given off from the positive plate. There are two very important things to be noticed. If we charge and discharge the cell a number of times, we will find that the energy we get out of the cell is less than the energy we put in by an amount that varies with the rate of discharge, the efficiency being less as the discharge rate is greater: the average efficiency for the present storage-cell is something near seventy per cent. Another point even more important than the first is, that, if we greatly increase the discharge rate, the electro-motive force of the cell will fall rapidly; and if we persist in this, the plates will corrode and buckle, and the plugs of active material will fall out of the holes in the plates. There is one more disadvantage besides these, and that is the fact that the life of the cell, especially that of the positive plates, is limited. Under favorable conditions, the positive plates will last, on the average, two years: the negative plates will last much longer.

For lighting, the most important disadvantages are the cost, the loss of energy, and the deterioration. The fact that the cells cannot be discharged at more than a certain rate does not greatly affect their usefulness in ordinary cases. And storage-batteries have reached such a state of development that it is safe to say, that, if they were sold and repaired at reasonable prices, they would have at once a great field of usefulness for electric lighting, even with their present defects. The principal cost of a storage-cell is for material: the cost of the labor is comparatively small, and, when the plates have given out, at least a part of the material is left.

But for traction-work the greatest disadvantage is in the slow discharge rate permissible. At present from three thousand to four thousand pounds of storage-batteries are required to drive an ordinary car, the storage capacity being enough for a run of from forty to sixty miles. This great weight increases the power necessary to run the car, the wear of the track, and the deterioration of the car. Besides, it means a considerable first investment, and a large battery to be kept in repair. If we could discharge the battery at any rate we wished, we could make a round trip with seven hundred and fifty to one thousand pounds of battery. We would have to charge our batteries oftener, of course, but we would greatly decrease our items of first cost, depreciation, wear of road-bed and cars, and even of power expended.

It has been variously estimated that the difference of expense between horses and the storage-battery, including every thing but the deterioration of the battery, is from one to three dollars per car per day in favor of the battery. Taking a well-known form of battery as a type, supposing fifty per cent over the cost of manufacture is charged for the cells, and estimating the cost of horse-power for one of the New York street-railways: the difference of cost of the two systems is roughly two dollars and a half per car per day. Now, whether the repairs of the battery will cost this much is a matter that only experience can settle, but on roads where the grades are slight it is very probable that the batteries will be most economical.

The matter at present stands thus: only about fourteen per cent of the possible storage capacity of storage-cells is utilized; their discharge rate is limited, so that even this comparatively small capacity is great in comparison to it; the cells deteriorate, so that a large item of expense is in repairs; the efficiency of the cells is not greater than seventy per cent. Even with these disadvantages, storage-batteries can be largely applied for lighting and traction-work. It seems impossible, with the number of investigators working on the subject and the great possibility of improvement, that the next few years will not see a great increase in the economy, storage capacity, and discharge rate of storage-cells; and a very moderate increase in any of these, especially the latter, will throw the balance decidedly in their favor for traction-work. For lighting, their field is equally extended.

PRIMARY AND SECONDARY CURRENTS IN INDUCTION-COILS. — The relations between the primary and the induced secondary currents in induction-coils have been investigated mathematically by several writers, the clearest and most satisfactory treatment being probably that of Mascart and Joubert. Since the experiments of Ewing on the magnetization of iron, it has been clear, not only that the assumptions hitherto made have not accurately represented the facts, but that any rigorous mathematical treatment would, with our present knowledge, be impossible. The work of Prof. Galileo Ferraris in this connection is important as showing the extent of the modification that can take place. He has determined experimentally the difference of phase between the primary and secondary currents in an old-type Gaulard and Gibbs transformer, and, comparing them with theoretical deductions of his own, finds the agreement satisfactory. The objections to his work seem to be that the apparatus he experimented on is obsolete, and is not of the type at present universally used; the old transformers having an open magnetic circuit, while now the magnetic circuit is always closed. The work is important, however, as showing the inadequacy of the at present accepted treatment.

ETHNOLOGY.

Notes on the Kwakiool of Vancouver Island.

DR. GEORGE M. DAWSON gives in the Transactions of the Royal Society of Canada for 1887 a very interesting sketch of the Kwakiool, a people inhabiting the central part of the coast of British Columbia. He describes the numerous tribes of this nation and their several villages, but the most interesting part of the paper is a description of their mode of life, traditions, and language. They live in large wooden houses, the front of which is painted with designs representing the fabulous thunder-bird, whales, snakes, or salmon, while the posts and beams supporting the roof are carved in similar forms. The children are for a long time kept tied into the cradle. When they leave it, the cradle and the bedding must be deposited at a place reserved for this purpose. Then a great festival is celebrated, and the child is given a name. On this occasion the father has to give away a great part of his property. Dawson gives very valuable information on this giving-away of property, which was well known to be practised by the tribes of the north-west coast, but the meaning of which was not clearly understood. He says, —

"The rules governing the *potlatch* (as this festival is called in the Chinook jargon) and its attendant ceremonies have grown to be so complicated that even those persons most familiar with the natives can scarcely follow it in all its details, and it is sometimes difficult for the natives themselves to decide certain points. The custom was formerly almost entirely confined to the recognized chiefs, but of late years it has extended to the people generally, and become very much commoner than before. It is regarded as a means of acquiring and maintaining prestige and power, but it has nowadays spread to all classes of the community, and become the recognized mode of attaining social rank and respect.

"As a particular instance of the custom, let us suppose that a man of one tribe has collected together as his own, or obtained control of, say, five hundred blankets, and wishes to make a *potlatch* to some other tribe. He goes to its village, and makes known his intention of distributing a thousand blankets at a certain date. He begins by lending out his stock of five hundred blankets, giving larger numbers to those who are well off. This loan is reckoned a debt of honor, to be paid, with interest, at the proper time. It is usual to return two blankets for every one borrowed. Thus the stranger obtains the thousand blankets for his *potlatch*, which, with the accompaniment of much bombastic speech-making and excitement, are distributed in exact proportion to the social position of those taking part."

Those who receive presents at such a festival become debtors of the man who gives the feast. These feasts are celebrated at a marriage ceremony or when a man wishes to take a new name.

In connection with the remarks on the *potlatch*, Dawson refers to the actual condition of this people, and emphasizes the fact that the best way to civilize them will be the establishment of industries among them. The report on the legends of the people is of great interest, and so is the vocabulary of about seven hundred words, which is of great importance, as our knowledge of that language is very scanty.

BOOK-REVIEWS.

Great Waterfalls, Cataracts, and Geysers. By JOHN GIBSON. New York, T. Nelson & Sons. 16°. $1.25.

Chips from the Earth's Crust. By JOHN GIBSON. New York, T. Nelson & Sons. 16°. $1.25.

THESE two publications present in a readable form certain phenomena of physical geography; the former treating of famous cataracts and geysers, the latter with a variety of geological phenomena such as obtrude themselves upon the attention of the reading public. The book on waterfalls and geysers is well illustrated, and the author has described almost exclusively those cataracts of which he was able to give an illustration. The papers of which the 'Chips from the Earth's Crust' consist were originally contributions to the *Scotsman* newspaper. Eruptions of volcanoes, great land-slides, tornadoes, discoveries of new gold-fields, the fall of a meteor, earthquakes, and similar phenomena, have given occasion to writing these papers; and we think the author has well accomplished his task to write in an agreeable form to such people as have no time and occasion for systematic study, but want to know what has been discovered regarding the history of the earth and the cause and true character of current geological events. The book contains a considerable number of illustrations.

Mineral Resources of the United States. By DAVID T. DAY. Washington, Government. 8°.

THE annual report on the mineral resources of the United States for the year 1886, compiled in the Division of Mining Statistics and Technology of the United States Geological Survey, has just been issued. We find in this volume, which is the fourth of the series, a minute and exhaustive report on the production and economic value of minerals in the United States. The arrangement is according to materials, and under each heading the total production, recently opened mines, technical improvements, imports and exports, are treated. The statistical tables of the preceding volumes have been brought forward to the close of 1886. Besides the report on the annual production, the volume contains a brief and interesting review on the American iron industry, from its beginning in 1619 to 1886, by James M. Swank, and an elaborate paper on the iron ores east of the Mississippi River, by John Birkinbine, to which are added analyses of foreign iron ores smelted in this country. The volume is very exhaustive, not only treating of metals, coal, petroleum, etc., but giving also a review of the production of structural materials, fertilizers, precious stones (the last by George F. Kunz); in short, of all minerals of any economic value.

The Soul, or Rational Psychology. BY EMANUEL SWEDENBORG. Tr. by Frank Sewall. New York, New Church Board of Publ. 8°. $3.

THE original of this work is in Latin, and it remained in manuscript for a century before it was published; and now, after some forty years more, we have a translation of it in English. It is hard to see, however, what useful purpose the book can be made to serve. It is true that the present interest in psychological studies is great, and men engaged in them are glad to receive help from any quarter. But they will not get any help from Swedenborg, owing to the unscientific character of his work. Every one, whether he knows much of Swedenborg or not, has heard of him as a mystic and as the founder of a religious sect. Now, mysticism, as Mill somewhere remarks, consists in attributing outward reality to the creations of our own fancy; and that this is the method of Swedenborg, a few examples of his work will show. He assumes that we possess a lower mind or *animus*, a rational mind or *mens*, and a soul or *anima*, and these are perpetually spoken of by him as if they were distinct entities. Precisely how he does regard them it is impossible to say, for his expression is obscure; but the following passage from the appendix to the present work, and which is taken from another of his treatises, presents his doctrine briefly in his own words: "The first of the organs is the spirituous fluid, or soul, whose office it is to represent the universe, to have intuition of ends, to be conscious, and principally to determine. The next organ under the soul is the mind, whose office it is to understand, to think, and to will. The third in order is the *animus*, whose office it is to conceive, to imagine, and to desire" (p. 357). Besides all these 'organs,' he speaks of something which he calls the 'pure intellect,' his description of which is so obscure that we confess ourselves unable to understand what he means by the term. The translator of the work thinks it is entitled to credit for recognizing the part played by the brain and the body generally in connection with mental phenomena; but, unfortunately for this view, Swedenborg's anatomy and physiology are quite as fantastic as his psychology. Thus, at the very beginning of his book, he undertakes to explain "the successive formation of the blood-vessels from the simple fibre," and he begins as follows: —

"The simplest fibre is the form of forms, or that which forms the other fibres succeeding in order. The simplest fibre by its circumflexion forms a certain perpetually spiral surface, or membrane, which is itself the second, the medullary or nervous fibre of the body, and is simply a little channel constructed from the simplest fibre, but, together with the fluid which permeates it, constituting a fibre. . . . This fibre, when it falls into the provinces of the body, again forms a kind of little gland not unlike the cortical, from which proceeds the bodily fibre, and this forms the little tunic which infolds the arterial vessels" (p. 3). And there is much more of the same sort. Now, those who believe Swedenborg to have been a divinely inspired teacher may perhaps accept such doctrines as these and such methods as their author employs; but to other persons his book will be chiefly interesting as an example of the aberrations of the human intellect.

Childhood: its Care and Culture. By MARY ALLEN WEST. Chicago, Woman's Temp. Publ. Assoc. 8°.

IN estimating the value of such a work as this, the public for which it is intended is a prime consideration. The scientific man will find little in it likely to attract him, and what there is he can find in a better shape elsewhere. But the majority of mankind are not of a scientific turn of mind, and, as they have the practical problem of educating their own children before them, it is both natural and advisable that they should have prepared for them a general treatise on the nature of childhood, answering a want analogous to that satisfied by works on home medicine. The spirit in which such works are written is always a reflex of the movement appealing most strongly to the leaders of culture. It is not difficult to trace in this large volume the influence of new and to a great extent better views upon such questions as the moral training of the young by means of the every-day usages of society, the proper dressing of children, the dangers surrounding them at critical stages in their development, and so on. Some rather objectionable features that are also new have likewise found their way into the work. Chief among these is the early acquaintance of children with the dangers of alcohol, — a topic ridiculously overdrawn. In brief, this handbook aims to put together, in a style apt to attract the uninformed reader, the views of childhood now considered as most satisfactory; taking much from the development known as 'infant psychology,' piecing in somewhat of child-lore and anthropology, and systematizing much of such information as is often found in a magazine like *Babyhood*. In doing this there are many mistakes, some serious and some not; but, on the whole, the work leaves one with the impression that it is more remarkable that it is not less satisfactorily performed than that it is not more so. The chief characteristic that marks off such a treatise from a scientific one, is that the former brings in so much irrelevant matter: it is not false, not uninteresting, but out of place. However, there is undoubtedly a taste for works of this kind, and we ought to be satisfied if they are no worse than this.

Life of Thomas Hopkins Gallaudet. By his son, EDWARD MINER GALLAUDET. New York, Holt. 12°.

THIS book is an interesting account of a worthy and useful man. It is written with filial reverence and affection, but, so far as we can judge, without undue bias; and the story is well told. Mr. T. H. Gallaudet was the founder of deaf-mute instruction in America, and the principal interest of his biography arises from this fact. Few among the charitable or educational improvements of modern times are more important than that which has enabled persons without the sense of hearing, to communicate with their fellow-men; and, though Mr. Gallaudet was not the inventor of the system, he was the principal agent in introducing it into this country. It was during the second decade of this century that he became interested in the subject, while he was a theological student at Andover, and, at the request of a number of other persons who became interested with him, he abandoned the idea of entering the ministry, and started for London to learn the methods in use in the school for deaf-mutes established there. To his surprise, however, he found that the teaching of deaf-mutes in England was a virtual monopoly in the hands of a certain family, the members of which refused to allow him to learn the system, lest their interest should thereby suffer. After trying for some time in vain to induce them to change their mind, or to obtain any means whatever of learning their system of teaching, he went to Paris, where he readily obtained access to the information he wanted at the Royal School for Deaf-Mutes. Returning as soon as he had qualified himself, he opened the first school of the kind in this country at Hartford, Conn., in 1817, and continued for many years to preside over it as its principal. His duties, however, were somewhat arduous, and his relations with the directors were not always harmonious; and after a while he resigned his position. During the rest of his life he was engaged in various charitable and educational enterprises. He married one of his own deaf-mute pupils, and there is abundant evidence in these pages that she became an excellent wife and mother. His son, the author of this biography, is continuing his father's work, being now the president of the National College for Deaf-Mutes in Washington. During the present year the deaf-mutes of the country will erect a statue of the elder Gallaudet on the grounds of the college at Washington, — a tribute to his memory that is well deserved.

An Explanatory Digest of Professor Fawcett's 'Manual of Political Economy.' By CYRIL A. WATERS. New York, Macmillan. 12°. 70 cents.

THIS little book is intended chiefly for those students who are preparing for examination in Professor Fawcett's work in the English schools and colleges, and for this purpose it seems to be well adapted. It fills some eighty pages, and gives an excellent summary of the original work in clear and intelligible language, the more important doctrines and arguments being given in many cases very nearly in Professor Fawcett's own words. The original work is in many respects one of the best of the shorter treatises on the science, but it contains some doctrines that are not accepted now by the majority of thinkers, that of the wages fund being the most important. Mr. Waters objects occasionally to some of Fawcett's views, and indicates one or two deficiencies in the professor's work; but he says nothing on the subject of the wages fund. Fawcett's work may be regarded as a briefer presentation of the doctrines taught by Mill, and hence this digest will serve to a certain extent as a summary of Mill's work also.

What Shall we Talk About? New York, T. Nelson & Sons. 16°. $1.

THIS is one of the old-style educational books, in which some parents or grand-parents entertain a party of children with wise and instructive stories and adventures. The present volume treats in this style a great variety of subjects referring to natural science. Descriptions of animal life, and anecdotes, come in for a large share of the space; but, besides, astronomical and physical phenomena are explained. We fear that some of the subjects treated, as well as the style of the book, are quite beyond the grasp of children as young as those for whom it is intended. The treatise on the physical properties of air on p. 139, to point out one instance, cannot be understood by children. The author neglects throughout the book to stimulate the power of observation, and gives theories instead. Besides, the cursory way in which phenomena having no connection whatever are treated without order and regularity must be rejected from an educational standpoint, as it promotes superficialness.

A Text-Book of Algebra. By W. S. ALDIS. Oxford, Clarendon Pr. 12°. $1.90.

THE present work is in its general plan similar to that of Professor Chrystol, published in 1886. While containing many of the new methods and conceptions which render the latter work so valuable, Aldis's work is less exhaustive than Chrystols', and does not depart so far from the ordinary text-books in general use as Chrystols' does. On this account it is better suited to teachers and students familiar with the rudiments of algebra. Indeed, the book is one which should be in the hands of every mathematical teacher in a high school, academy, or college in the country. It is only by the help of such works as the present one that mathematical education can be raised to a higher standard than it at present possesses.

The peculiar excellences of the book are found in the two opening chapters, which together occupy fifty-one pages. The book begins with a thorough discussion of arithmetical ideas. The process of counting leads to the idea of positive integers; thence addition, and its inverse operation subtraction, arise; next come multiplication, and its inverse division. By division we are led to the idea of fractions.

Chapter II. is devoted to algebraic notation. By subtraction we are led to the idea of negative numbers. The laws governing such numbers are fully discussed and carefully illustrated.

At the end of the second chapter is introduced a brief treatment of vector quantities: this is introduced simply to show the student that "algebra is something very much wider in its scope than a mere substitution of letters for numbers to aid in the solution of general arithmetical problems." These words are the author's own.

The remainder of the book differs little from the well-known text-book of Todhunter. The last chapter, on choice, might have been extended with advantage.

The book is marred by clumsy and faulty language. Many of the definitions lack precision, and many terms are introduced without definition. Some words are made to have two inconsistent meanings.

NOTES AND NEWS.

THE first number of the *Internationales Archiv für Ethnographie* has just been issued. The new journal is edited by J. D. E. Schmeltz, curator of the National Ethnographical Museum at Leyden. It is novel in plan, being exclusively devoted to the discussion of the ethnographic specimens collected among the various tribes and races. The journal will make accessible by illustrations the collections deposited in the various museums of the world. The text will contain papers in French, English, German, and Dutch, according to the choice of the author. The subjects of the papers will be the ethnographical results of expeditions, descriptions of newly discovered ethnographical objects, and studies of collections. Objects the origin of which is doubtful will be figured and discussed. The plan of the journal includes also the study of prehistoric remains. As the material for ethnographical studies is so widely scattered in private and public collections, the establishment of such a journal must be welcomed by all students of the science of man. In order to make it the centre of such studies, a number of co-editors in various countries contribute to the journal. The first number shows that the journal will be of the greatest value. Three beautiful chromolithographic plates and a number of cuts illustrate the text. The plates show a large collection of New Guinea arrows, to illustrate a paper by Dr. L. Serrurier, in which the various forms of arrows of this large island are ably discussed, and the principal object of which is to show that only a large collection will enable us to determine the typical forms of ethnographical objects, and to draw reliable conclusions. The third plate is devoted to the mandaus, the sword of the Dayak, the manufacture and ornaments of which are described in detail by S. W. Tromp. This paper is illustrated by a series of cuts showing the ornaments and various forms of handles. The rest of the paper is taken up by notes on recent additions to collections, a bibliographical review, and a discussion of objects of doubtful origin. The periodical is to appear bimonthly, and each number will contain about twenty-four pages text in quarto, and three chromolithographs. The journal is published by O. W. M. Trap, Leyden.

— The most interesting feature of the twenty-first report of the trustees of the Peabody Museum is Professor Putnam's report on the purchase of the Serpent Mound in Adams County, O., for which a number of ladies of Boston subscribed a sum of nearly six thousand dollars, and on the steps taken to secure the preservation of the interesting monument. Eight weeks were given to the careful restoration of the great earthwork, erecting a fence about it, so that only persons on foot can enter the enclosure. The land was cleared of brush and briers, and the mound was sown with blue-grass-seed. A road half a mile long was made, extending to a grove of maples in the south-eastern corner of the grounds, in which are two springs. This grove has also been enclosed by a fence. A substantial spring-house of stone has been built, and trees are now being planted along the road. A gravel path has been laid out from the spring to the serpent, and various other improvements have been made. It is highly gratifying that Professor Putnam has succeeded in preserving this remarkable monument, and the liberal action of the subscribers will undoubtedly be a material help to future endeavors to preserve ancient monuments in the United States. Several changes have taken place in the board of trustees of the museum: Col. Theodore Lyman resigned his trusteeship, and Mr. Samuel H. Scudder was elected his successor. George F. Hoar, who resigned the presidency of the American Antiquarian Society, was succeeded by Stephen Salisbury. Professor Putnam became trustee as president of the Boston Society of Natural History. Professor Gray was succeeded by Professor Lovering, president of the American Academy of Arts and Sciences.

— A new thermometer for measuring the temperature of the air has been constructed by R. Assmann. In order to protect it from the influences of radiation and other sources of heat, he inserts the bulb of the thermometer in a metal tube which is open at its lower end. An aspirator is fastened to the tube near the bulb, and a continuous current of air of about seven feet velocity passes the latter. Thus it assumes the true temperature of the air. The tube is made of highly polished nickel-plated brass in order to protect it from radiation. Experiments show that this thermometer gives entire satisfaction. Two instruments, one of which was exposed to the sun in July while the other was shadowed, showed the same temperature. A dry and a wet thermometer being inserted in the tube, it serves as hygrometer in the same way as the ordinary thermometer. Undoubtedly the device is superior to the arrangement of thermometer now in general use.

— Prof. David S. Martin is about to publish the large-scale geological map of the environs of New York City, which he exhibited at the recent meeting of the American Association for the Advancement of Science. The object is to furnish a map in which all those important geological features which were not before brought together in one representation, can be clearly seen by an audience or a class. The coloring will be the same as in Hitchcock's geological map of the United States.

— The *Journal of the Royal Society of New South Wales* for 1886 contains a very interesting sketch of the history of the floods in Lake George, by H. C. Russell. The lake has no outlet, and since its discovery in 1820 it has been dry twice. According to reports of the natives, the basin contained no water for some time previous to 1820. In 1823 it reached its highest level, attaining a maximum depth of twenty-four feet. Then it commenced to dry up, and in 1838 and 1839 it contained no water. In 1840 four feet of water were found in the basin, which, however, from 1845 to 1849, was again completely dry. During the ensuing ten years the lake began to fill, but in 1859 it was dry for the third time. Since that time it steadily increased in size until 1874, when it reached the same height as in 1823. This record is of great interest, as it shows the alternating periods of humidity and dryness. It is particularly important in connection with Seibt's and Brückner's studies of similar changes in the levels of lakes in the northern hemisphere, which were noticed in No. 232 of *Science*. Brückner arrived at the conclusion that the whole of the northern hemisphere passed through a dry period between 1830 and 1840. This was followed by a period of increased humidity about 1850. A new dry period developed between 1860 and 1865, while after 1875 the precipitation increased. The periodical changes of Lake George agree with these results. From these and several other facts, Brückner infers, in reviewing Russell's paper, that the whole earth takes part in these periodical changes.

— Domingos Soares Ferreira Penna, the Brazilian naturalist, died at Pará, Brazil, on the 8th of January. During the last twenty-five or thirty years not a naturalist has done any work in the Amazon region who is not more or less indebted to Snr. Penna in one way or another. Agassiz and Hartt and the members of the late geological survey of Brazil were greatly aided by his valuable personal knowledge of the region, and by his useful suggestions. He was at one time secretary of the province of Pará, and at the time of his death was director of the Provincial Museum at Pará.

LETTERS TO THE EDITOR.

**** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

Twenty copies of the number containing his communication will be furnished free to any correspondent on request.

The editor will be glad to publish any queries consonant with the character of the journal.

Ratio between Men and Women.

PROF. W. K. BROOKS of Baltimore has discovered that a favorable environment tends to produce an excess of females among animals and plants, and an unfavorable environment an excess of males. If this be true, a race or species which is on the point of extinction should have an excess of males.

The population of Australia consists of a small and decreasing number of aborigines, and a prosperous and increasing population of foreign settlers and their descendants, amounting, in all, to nearly three millions of persons. As the native population is rapidly disappearing, we should expect to find the males more numerous among them, as compared with the females, than among the inhabitants of foreign origin, provided other conditions are equal. For each 100 females there were in Victoria, of native-born Australians, $100\frac{8}{10}$ males; and of foreigners, exclusive of Chinese, $129\frac{1}{10}$ males. The ratio of males to females in the population of foreign origin is therefore very much greater than it would be if it depended upon the birth-rate alone; and, as this modifying influence does not affect the aborigines, an excess of males among them no greater or even a little less than that found among the inhabitants of foreign origin would indicate that the excess of male births is much greater among them than among the people of foreign origin. Computation shows that the excess of males among the aborigines is, notwithstanding these neutralizing influences, very much greater than it is among the foreign population.

For all Australia there are 143.72 aboriginal males to each 100 females; there are only 118.64 males of foreign descent to each 100 females, notwithstanding the fact that 129 males settle in these colonies to each 100 females.

To those who wish to follow this subject further, it may be interesting to know that an enormous collection of statistics relative to the Indian tribes of the United States was made under the direction of Maj. J. W. Powell. The results of this census have not been published, but the material is still available, and would furnish a much better basis of comparison than the one chosen by Professor Brooks. O. T. MASON.

Washington, D.C., Feb. 27.

Classification of Diphtheria.

THERE is a very striking resemblance between the membrane of diphtheria and the fungi that produce dry rot, or more especially those forms that grow in living trees. A white or yellow leathery substance is produced, sometimes known as 'punk,' — the *Merulius lachrymalis* in dead wood, and some species of *Polyporus* in the living. The hyphæ, or roots, penetrate the cells of the wood in every direction, producing disintegration and decay.

Diphtheria is called an exudation, and classed as a bacterial disease, a *Schizomycetes*, when in fact it is a fungus of a higher order, a *Hyphomycetes*. It grows on the surface, and spreads by fibulations, and its roots penetrate deeply into the tissue, producing changes and decomposition, which becomes the soil for bacteria, generating poisons that are absorbed and powerfully affect the whole system. In this view its life-history has not been studied or found out. It is known that the membrane can be transplanted, and that the surface abrasions on which it grows are of a painful, smarting kind. How it is propagated by spores is unknown. There is evidently some peculiar condition required, as in the *Merulius*, which will not grow unless an alkali is present. It may be that an alkaline condition of the system is required, which is the reason of the capriciousness of its infection.

The treatment of the disease in this light assumes a new aspect, and gives purpose to thorough local antiseptic applications; i.e., thorough eradication of the fungi before it can have time to poison the system. P. J. FARNSWORTH.

Clinton, Io., Feb. 22.

Sex and Consumption.

I WAS delighted at seeing the main tendency of the article on sex and consumption, that appeared in *Science* of Feb. 3. The views that I have since 1882 been trying in vain to get investigated here, appear to be receiving serious attention in your great country. That this progress in a question of nothing less than the life or death of a large multitude of the civilized world may not be checked by the presence of one or two erroneous inferences in that article, I shall be glad if you will permit me to point them out.

Although for the present time it is true that the total male mortality exceeds that of the female, yet that neither applies to all periods of life, nor is the difference so great as to justify the term 'protected' to the female in any sense. From the age of five to fifteen, the female mortality from consumption is much greater than that of the male, and it is in the later periods of life that the latter preponderates. Further, in the strictly rural districts the female mortality exceeds that of the male; and it is only within a comparatively recent period that the total male mortality has exceeded that of the female, and that has been brought about by men who had been brought up and engaged in country pursuits, rushing into town employments. One word more. An organ that is subject to hyperæmia does not gradually waste away, and hence we must look elsewhere for an explanation of the mode in which those conditions of our civilization that tend to reduce the capacity of the chest produce consumption. G. W. HAMBLETON.

London, Feb. 16.

A Worm in a Hen's Egg.

THE nematoid worm sometimes found in the white of the hen's egg is not *Ascaris lumbricoides*, as your correspondent of last week supposes, but a *Heterakis*, generally *H. inflexa*, the normal habitat of which is the fowl's intestine, but which occasionally wanders into the oviduct. R. RAMSAY WRIGHT.

Toronto, Ont., Feb. 28.

Calls for Domestic Animals.

IN reply to Mr. H. Carrington Bolton's query in relation to terms used in addressing domesticated animals, I beg leave to give information regarding the terms used by the Eskimo of Cumberland Sound and Davis Strait in addressing dogs. To start dogs, a whistling sound made in the throat, and strongly aspirated, something like *h! h!* is used. For urging the dogs, a great variety of terms are used, the most common of which are the following, expressed in the phonetic alphabet of the Bureau of Ethnology: *ak* (the *k* being very guttural); *yatit*; *uī* (the *i* pronounced in a very high key, and lasting from about five to ten seconds); *a* (pronounced in a similar way); *yauksa kōksa*; the same sound as the one used in starting the dogs. For stopping the dogs, a deep *ō*, drawn very long, is used; for making them lie down, a similar *ō* spoken in a low voice, and at the same time the whip is gently thrown over their heads. In order to turn to the right, the driver sings out, *au'a au'a ya au'a*, throwing the whip to the left; to turn to the left, the term *qoi"a qoi'a ya qoi"a* is used. For driving dogs from some food or other things they may attack, the term *ha!* preceded by the name of the dog, is used. DR. F. BOAS.

New York, Feb. 20.

Vermin-Eaters.

CERTAIN aborigines of South America are addicted to a peculiarly disgusting habit, as the following extract from A. Simson's 'Travels in the Wilds of Ecuador' attests: "Lice of different species are the most abundant, and it is among the commonest sights to see the inhabitants engaged in their chase, keenly pursuing them in each other's heads, and cracking them, when captured, between their teeth" (p. 9). It is interesting to compare this with the evidence of a traveller in another part of the globe. Octavius G. Stone, in 'A Few Months in New Guinea' (Franklin Square Library edition), says, "A very favorite pastime, particularly of the women, is hunting in each other's heads for vermin. Two, three, or four in a row, sitting one behind the other, might be constantly seen in front of my tent, pursuing their favorite amusement. It is a common one among most colored races, and a wholesome practice to boot. But *eating* the lice is another affair. I could hardly believe my own eyes when I first saw them engaged in this disgusting employment; yet they not only eat every one caught, but appear to do it with considerable zest and relish. Whether they believe it nourishing, or take it simply as a *bonne bouche*, is not quite certain, but opinion inclines toward the latter theory" (p. 11). Whether this be the correct explanation or not, remains to be seen. Certainly it is not for lack of food that the practice is kept up. Is the practice known to exist elsewhere in America? The tribes visited by Mr. Simson were the Piojes and Jivaros; those seen by Mr. Stone belonged to the Motu district of New Guinea. Perhaps when all instances of the occurrence of this strange habit have been collated and examined, a clear and satisfactory explanation of it may be given. In the mean time, I simply call attention to this interesting point in the anthropology of the Naturvölker.

A. F. CHAMBERLAIN.

Toronto, Feb. 15.

IN addition to Mr. Chamberlain's quotations, I would say that the custom of eating vermin is a wide-spread one, although most travellers do not mention it in their reports. Parry and Lyon, as well as Hall, found it practised by the Eskimo of Hudson Bay and Frobisher Strait. I found the same habit among the Eskimo of Cumberland Sound and Davis Strait, and I well remember a father carrying his three-year-old child, and feeding it with the lice he picked from its head. F. BOAS.

New York, Feb. 25.

The Snow-Snake and the r-Sound.

DR. BEAUCHAMP will, I am sure, agree with me that the presence of the snow-snake game among the Southern Iroquoian tribes can be more firmly established by the evidence to be obtained directly from the traditions of those Tuscaroras who early in the present century came directly from the South to their present habitation in Niagara County, N.Y., and by the evidence of language, than in any other way.

In these traditions the *Tci-ru-hă'-kā'* (the Nottowayans), among others, are mentioned as contestants with the *Skă-ru'-rĕ*^{n}' (Tuscaroras) in this game of snow-snake.

The name of the so-called 'snow-snake' in the language of the Tuscaroras is *u-tră-hwĕ*^{n}*-tĕ* (misprinted in my former article); and of the game, *nä-yä-tră-hwĕ*^{n}*-tă'-yĕñs* (literally, 'they two bet snow-snake'). *U-tră-hwĕ*^{n}*'-tĕ* is a pure noun, having the power of composition either with verbs or adjectives, and also having a declension to express the nominative and oblique cases, — circumstances that in the nature of the language assign to the noun an age far antedating the wars of 1711-13. The game was played in winter, and a slight modification of it in the summer.

The southern limit of snow at sea-level is, in the United States, the 30th parallel of northern latitude; and, as the territory of the Southern Iroquoian tribes lay between the 35th and 39th parallels, it is quite likely that they often had winters 'appropriate' for the use of the snow-snake.

With the assistance of some very intelligent Onondagas, some of whom spoke Tuscarora and Oneida in addition to their own tongue, I collected, in 1880 and 1884, with other linguistic matter, a vocabulary of more than fifteen hundred words and over five hundred and fifty phrases and sentences, and I also made translations of two quite lengthy aboriginal compositions. In the prosecution of these linguistic studies, great care was taken in verifying the work at every stage of it. No *Onondagan* word was found in which the *r*-sound was used.

Mr. Albert Cusick, a man of intelligence and education, was one of my assistants in these investigations.

The Onondagan, like the Senecan, tongue of to-day has either transmuted the *r*-sound into an aspirate, or has simply suppressed it.

Mr. Horatio Hale, the eminent linguist and ethnologist, says (*Book of Rites*, p. 46), "In former times, as we know from Jesuit vocabularies, the sound of the letter *r* existed in the Onondagan dialect. Since their day the sound has disappeared from it entirely."

Dr. Daniel Wilson, in his lecture on the Huron-Iroquois of Canada (*Trans. Roy. Soc. of Canada*, 1884, Sec. II. p. 105), states that the *r*-sound is "no longer heard" in the Onondagan tongue.

No one denies that the *r*-sound once existed in the speech of the Onondagas, as it is still common to nearly all of the cognate dialects.

The orthographies and translations of both Schoolcraft and Zeisberger are so inaccurate and untrustworthy that it seems strange to see them quoted as authority on a point of phonetics requiring precision and accuracy of observation, and record of language, for its proper determination.

Dr. Beauchamp says that in a version of the Lord's Prayer sent to him by a native Onondaga in that tongue, "the letter in question frequently occurred, but the sound was obscure. I went over the version with him syllable by syllable, to get the exact sound, and retained the letter four times as clearly enunciated."

Faulty articulation quite probably accounts for these four *r*'s retained by the doctor.

In the summer of 1884, I obtained from living Onondagas, and not from 'lifeless books,' a version of the Lord's Prayer in which the *r*-sound does not once occur.

One difficulty experienced in my work was to obtain the Onondagan orthoepy of a word. The intercommingling with the Onondagas, of persons speaking cognate languages in which some form of the *r*-sound occurs, is in many instances the cause of the unconscious mispronunciation of a word.

To the student of Iroquoian tongues faulty articulation, worse orthography, and *otosis* (defective hearing) are fruitful sources of error.

Every Indian is not competent to furnish satisfactory linguistic data. Equally deficient are many collectors of vocabularies and linguistic material.

Recognizing these difficulties, the Rev. Ashur Wright, who knew well what Iroquoian orthoepy and orthography require, says, on the sixth page of his valuable Senecan spelling-book, printed in 1842, "It is sometimes, also, very difficult to decide on the correct usage, where there are differences of pronunciation among the Indians. In such cases we have sought for the pure Seneca in contradistinction from the *idioms of Mohawk, Cayuga, Onondaga*, etc., and for Seneca as spoken by the old men."

With these facts in view, I cannot accept Dr. Beauchamp's use of the *r*-sound in his orthography *ka-wher-tah* for *kă-whe''-tā'*.

J. N. B. HEWITT.

Washington, D.C., Feb. 18.

Queries.

29. THE JACKSON MEDALS. — In 1874 or 1875 a farmer brought to this city and sold to Mr. W. H. Daum a silver medal which his boys found in a stone tumulus, supposed to be the grave of Little Bear, an Osage chief. The medal is three inches in diameter, has on its face the profile of Jackson, with the words, "Andrew Jackson, President of the United States, A.D. 1829," and on the reverse a pipe and a tomahawk crossed, two hands clasped, — one that of an Indian, and the other of the President, — and the words "peace and friendship." Can you or any of the readers of *Science* tell me why these medals were given to the Indians, and whether the practice is a common one? L. C. WOOSTER.

Eureka, Kan., Feb. 23.

Answers.

26. THE EARTH'S ROTATION AS AFFECTING RAILWAY-TRAINS. — Mr. Goodridge will find a partial answer to his query, in 'The Annual Report of the Chief Signal Officer for 1885,' Part II., which forms W. Ferrel's 'Recent Advances in Meteorology,' p. 191. After having shown that a body moving in any direction on the earth's surface is deflected, and giving the formulas for computing the deflecting force, the example is treated, "If a railroad-train on the parallel of 45° runs at the rate of forty miles per hour, what would be the lateral pressure per ton of the weight of the train on the side of the rails if both were on the same level?" and the answer is given that it would be 0.38 of a pound per ton of two thousand pounds. In reply to this query, a writer in *Engineering News* quotes the famous 'Bär's law' regarding deflection of rivers. Ferrel's formula shows that the action of the earth's rotation is not at all confined to a body moving in the direction of the meridian, as this writer also assumes. Ferrel gives an example of this kind, and finds that a river one mile in width, flowing in latitude 45° at the rate of four miles per hour, will be 1.2 inches higher at the right-hand bank than at the left-hand bank. F. B.

New York, Feb. 25.

21. GLOBULAR LIGHTNING. — Apropos of this subject, let me mention three cases which have come to my knowledge in such a way as to inspire confidence in them. The first in order of time occurred about 1859 or 1860, and was witnessed by a lady, the wife of a prominent physician. She was lying down for an after-dinner nap one summer day. From her letter I quote what seems pertinent: "The experience was this, and at The Forest Grove House, Schooley's Mountains. . . . We were aroused by a sudden and quite heavy hail-storm. . . . I immediately went to the open window, putting it down, leaving just space enough to put out my hands, in which I enjoyed the fun of catching the stones to eat. . . . This was only for a few minutes, when we were terribly startled by a flash of lightning and a peal of thunder, and I saw what appeared to be a ball of fire the size of my head come down the body of a tree about three yards from my hands. . . . The flash, the thunder, and the ball seemed simultaneous. . . . The tree did not afterward show the usual appearance of being struck, except just at the roots, where the ground was torn up for quite a little distance. . . . The house was struck at the same time and set on fire at the roof, but at its farthest point from us. . . . I was the only one who saw the ball of fire, but I have never doubted that I really did see it. . . . It was too plainly before my very eyes." The second case occurred a few miles north of Lambertville, N.J., in July, 1879. A barn was burned, and the company which had insured it instituted an investigation to determine the cause of the fire. From the testimony, I quote that of two men who swore that they saw "a cylindrical form of fire, apparently about three feet in diameter, and from six to eight feet in length, fall with a whizzing sound. . . . No thunder was heard, nor did any rain fall at that time. . . . Others also saw the strange occurrence." These men were in Pennsylvania, across the Delaware River, about a mile from the spot where the barn was burned. The third case was at Connersville, Ind., in August of 1881. Mr. L. L. Broaddus wrote me that it was about twenty minutes before four in the morning when the family and several neighbors were roused by a terrific crash. One of the neighbors, living nearly half a mile away, slept in a room from which she could see the Broaddus mansion. She saw a bolt strike a tree and burst like a bomb, scattering fire-balls over the yard, and brilliantly illuminating the premises. Mr. W. H. Broaddus and his wife slept on the side of the house where the tree was, and saw the 'second act;' that is, the fire-balls rolling about. They say the phenomenon lasted long enough for them to collect themselves and call occupants of other rooms, who, however, did not arrive in time to witness the display. The duration of the phenomenon was estimated by those who saw it at about a minute.

F. C. VAN DYCK.

New Brunswick, N.J., Feb. 20.

21. GLOBULAR LIGHTNING. — It may throw further light upon this interesting phenomenon to quote several additional reports received by the United States Hydrographic Office from masters of vessels; and, by permission of the hydrographer, I have selected the following as likely to be of interest in this connection. The phenomenon seems to be by no means unusual at sea, and perhaps some readers of *Science* who have devoted special attention to the study of electricity will contribute new facts or suggestions which may lead to a satisfactory explanation. The instances already cited (*Science*, x. p. 324, xi. pp. 38, 62), with those given below, would seem to furnish a very good basis upon which to build a theory. A further discussion will also be valuable as indicating, possibly, certain important details of observation which have hitherto been neglected, but which it might be practicable to attend to, even on shipboard. Captain Moore, British steamship 'Siberian,' in addition to the report already given, states that he encountered a severe electric storm Jan. 17, 1887, latitude 42° 50' north, longitude 59° 14' west; dark, gloomy weather, with rain and sleet. Between 8 and 9 P.M., during shift of wind from south-west to south-east, a brilliant display of St. Elmo's fire was observed, taking the shape of balls of fire shooting up from the horizon all around the vessel, and bursting at an altitude of about 5°. One ball, showing a green light, was mistaken for a vessel's side-light; brilliant lightning to the south-west. Captain Bowers, American bark 'Hannah McLoon,' encountered a severe electric storm Feb. 27, 1887, latitude 37° 17' north, longitude 73° 56' west, during a stormy gale from the south-west; all points and all wire rigging brilliantly illumined; fire-balls flying in the air. Captain Mitchell, British steamship 'Mentmore,' experienced a succession of terrific hurricanes from west-north-west during a voyage from Liverpool to Baltimore. Jan. 28, 1885, at 2.30 A.M., a ball of St. Elmo's fire fell between the bridge and foremast, and afterwards played upon the foremast and gaff. This ball of fire was so bright that for a time it blinded the officer on watch. Captain McKinnon, British brig 'Nellie Crosby,' encountered a remarkably severe electric storm Nov. 30, 1886, off Minot's Ledge light, Massachusetts, with terrific thunder and blinding lightning. A ball burst between the masts, completely blinding all on board; heavy rain; sea full of phosphorescence. Captain Sparks, American bark 'John H. Pierson,' reports witnessing an unusual phenomenon during a hurricane, Aug. 25, 1886, between the hours of 9 and 11 P.M. The sky was completely overcast, the weather dark and gloomy, and rain falling heavily. In the northern horizon, balls of fire were seen to shoot upwards, reaching an elevation of at least 30°, and covering a horizontal angle of at least 20°. The display continued at frequent intervals during the time mentioned. Captain Bodden, British schooner 'Clara L. Dyer,' reports that on Sept. 20, 1887, when in the Gulf of Mexico, about two hundred miles south by east from South Pass, had very heavy rain-squalls with thunder and lightning. The effect of the lightning was very peculiar, as it seemed to issue from the waves instead of from the heavens; thought at first it was due to the phosphorescence of the water, but the flashes seemed too plainly marked for that.

EVERETT HAYDEN.

U.S. Hydrographic Office, Feb. 20.

BOOK-NOTES.

— Who are the anarchists? What is their doctrine? Why would they overthrow society and government, and what do they wish to substitute? — these are questions frequently asked by thoughtful citizens. An article by Z. L. White, in the March number of *The American Magazine*, will answer such inquiries, and show the depth and virulence of the disease of which the Haymarket murders were only a symptom.

— We have received an extract from Alden's 'Manifold Cyclopædia.' The publication is intended to be a cheap cyclopædia and a dictionary of the English language. As it draws from trustworthy sources, it is reliable, and the print and the illustrations are good, considering the marvellously low price of fifty cents per volume.

— T. Y. Crowell & Co. will publish next month 'Taxation in American States and Cities,' by Prof. Richard T. Ely of Johns Hopkins University, a member of the Maryland Tax Commission.

— Henry Holt & Co. have just issued, in a handsome volume, 'The Life of Thomas Hopkins Gallaudet,' founder of deaf-mute instruction in America. The work is a very interesting one, and will have interest for others than the deaf and their friends.

— Brentano's 'New York City' will issue in a few days a book by Walter Hubbell, the successful exposer of modern Spiritualism, entitled 'The Great Amherst Mystery,' which the author claims is a true narrative of actual experience with ghosts in a haunted house, which he entered intending to expose a fraud, and remained to take the notes which he has now made use of to startle and convince his readers.

— J. B. Lippincott Co. will issue on March 1, in connection with the Edinburgh publishers, the first volume of a new edition of 'Chambers's Encyclopædia,' to be completed in ten volumes, following one another at short intervals. The maps will be increased in number, and a special set for the United States introduced. In lighter literature they are preparing 'Stanley's Expedition for the Relief of Emin Pacha;' 'Half-Hours with the Best Foreign Authors,' in four volumes, arranged by Charles Morris; and the sixth and seventh volumes of Furness's *variorum edition* of Shakspeare, devoted to 'The Merchant of Venice.'

— An English edition of *Babyhood* will be begun with the April (1888) number, the magazine being issued simultaneously in London and New York.

— P. Blakiston, Son, & Co., medical and scientific publishers, booksellers, and importers, 1012 Walnut Street, Philadelphia, published Feb. 24 the sixth edition of 'Memoranda on Poisons and their Antidotes,' by the late Dr. Thomas Hawkes Tanner, revised by Dr. Henry Liffmann, the medico-legal expert of Philadelphia. They have also just published 'Practical Physiology, including Chemical and Experimental Physiology,' by Prof. William Sterling of Owens College, Manchester, illustrated with one hundred and forty-two wood-engravings.

— The March volumes of Ticknor's Paper Series are as follows: 'Adventures of a Widow,' by Edgar Fawcett; and 'Indian Summer,' by William D. Howells.

— Dr. H. C. McCook's charming book on insect-life, 'Tenants of an Old Farm,' having been through several editions here in the hands of Fords, Howard, & Hulbert of New York, has now been brought out in England by Hodder & Stoughton, with an introduction by Sir John Lubbock, the distinguished entomologist.

Proceedings of Societies.

Anthropological Society, Washington.

Feb. 21. — J. Curtin, Myths and Folk-Tales of Ireland.

Biological Society, Washington.

Feb. 25. — Robert T. Hill, The South-western Termination of the Atlantic Timber Belt; F. W. True, Changes in the Catalogues of North American Mammals since 1879; T. H. Bean, Distribution and some Characters of our *Salmonidæ*; Cooper Curtice, Some Early Stages in the Life-History of *Tænia pectinata*.

Science Club, Lawrence, Kan.

Feb. 24. — V. L. Kellogg, Clays and Kaolinite; Notes on Bacteria in Potable Water; W. S. Franklin, The Axioms of Geometry.

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SCIENCE

FRIDAY, MARCH 9, 1888.

THE ADDRESS OF Maj. J. W. Powell on evolution in civilized man, delivered before the Anthropological Society of Washington on Tuesday evening, a full abstract of which is given in our Washington letter, will be found interesting and important. It will be seen that Major Powell rejects the doctrines of evolution as applied to the development of civilized man by the Spencerian school of philosophers. He presents his argument in his usual lucid and forcible manner, and illustrates each point copiously. This address is more popular in its character than either of Major Powell's previous papers on the same subject, but as a scientific discussion of an important scientific question, it is, in our estimation, the best of the series.

THE LATEST REPORTS received by the Hydrographic Office about the logs of the great raft abandoned south of Nantucket about two and one-half months ago, prove, that, though they are now widely separated, their general drift has been in an east-south-east direction, the logs being found a little to the southward of this line. That they were not carried more to the northward and eastward by the Gulf Stream, as would be expected, was probably due to the strong north-west winds which prevailed during the latter part of December and the first part of January. Fortunately, no vessel has been disabled by collision with them, although the German bark 'Bremen,' which was in company with the logs for five days, in latitude 39° north, longitude 62° west, had her sheathing torn and rudder injured.

THE NEW YORK ACADEMY OF SCIENCES was organized in 1817 as the Lyceum of Natural History. It is fourth in point of age among American scientific societies. The name and constitution were changed in 1876. 'The Annals,' begun in 1824, have been distributed in all lands, and have given world-wide reputation to the society. The Transactions, begun in 1881, give a record of the meetings, papers, and discussions, are published in monthly or bi-monthly numbers, and make an octavo volume each year. The library now numbers over eight thousand titles, and is especially rich in sets of the publications of foreign societies. It is now on deposit in the Library Building of Columbia College, and is accessible to the public from 8 A.M. to 10 P.M. every day of the year except Sundays. The cabinet was destroyed by fire in 1866. Previous to that date it was the principal collection in the city, and did a noble work. The academy has long looked forward to the time when it could secure a building of its own, such as the corresponding societies in Boston and Philadelphia have long enjoyed. It is not to the credit of New York that its oldest scientific organization, after nearly three-quarters of a century of steady and persevering activity, should be still unprovided with a building, while many other cities can show noble monuments of scientific interest and public spirit. Why should not the recent meeting of the American Association in this city be permanently commemorated by the erection of a fire-proof building for the accommodation of the academy, or perhaps of several other societies under the same roof, — a building which should be at once a benefit and an honor to the metropolis of America? The interest of the community has been aroused and quickened in the direction of science by the meeting of the association, and the Academy of Sciences would now invite the citizens of New York to take a greater interest in its work.

THE NATIONAL ELECTRIC LIGHT CONVENTION.

THE National Electric Light Association met in Pittsburgh on Feb. 21, and continued in session for three days. The association is mainly made up of representatives of the various arc lighting companies and of the alternating system of incandescent lighting. As Pittsburgh is the headquarters of the Westinghouse Company, and as the Westinghouse Company practically represents just at present the alternating system of electrical distribution, the investigation and discussion of the system occupied a considerable part of the time of the convention, although a couple of papers were read on underground electrical conductors, and other subjects were discussed which will be mentioned below.

The most important paper was by Mr. T. C. Smith, the title being 'The Distribution of Electricity by Alternating Currents.' The alternating system, briefly, consists in distributing the alternating currents at high potential, reducing to the low potential necessary for safety and for the running of incandescent lamps, by means of 'transformers,' — that is, induction-coils working backward, — changing high-potential to low-potential currents. Mr. Smith's paper gave the practical experience he had gained in working with the system, and very frankly told some of the difficulties he had met. With regard to the best way of running the circuits, he says, "The general question as to whether it is better to use separate circuits for separate machines, or to couple them into a general set of 'bus' wires and distribute from them, is too large to be lightly decided; as also is the question as to whether it is best to run separate circuits for separate districts, or to run into a general system of high-pressure mains outside of the station, feeding into these mains at different points, and again distributing from them. . . . There seems to be no doubt that in underground systems the network of high-pressure mains would be best, but for over-head work we have adopted the system of separate circuits from separate dynamos. . . . I now come to the question of the placing of the converters; and for this I think that you may safely lay down the general rule, that, wherever you are simply carrying current, do it at a high potential, and keep your low pressure for purely local distribution. With proper precautions, I do not see that there is any real danger in carrying the high-pressure wires into and through the building. . . . We started in with the idea that it was better, in cases where we had from the number of lights in a building to use more than one converter, to bank them; that is to say, connect all the primaries and all the secondaries in parallel, . . . but two or three peculiar experiences have led us to change our plans, and never to do so if it can be easily avoided."

Following Mr. Smith's paper was one by Mr. Shallenberger, on 'The Energy of Alternating Currents.' The first part of this paper was a description of the ordinary and well-known phenomena of alternating currents: they have been sufficiently described in a former paper in this journal.[1] The following, however, is suggestive: "The question naturally arises, What effect does this new element of self-induction have on the possibilities of practical measurements of alternating currents for commercial work?" The two cases in which the effect is negligible are, 1st, the measurement of the current through an incandescent lamp; and, 2d, the current supplied to lamps through converters with cores far below saturation, and carrying a fair proportion of their full normal load. "There is a third case, however, which arises in practice, in which central station instruments give a somewhat false notion of the actual energy transformed to the circuits; and this is the one in which a large number of converters are connected to the primary circuit, but with the secondaries open." In this case we may have no energy transformed, "while at the same time a considerable reading might be shown on the current instruments."

Now, I have quoted from these papers principally because I wish

[1] Abstract of paper on alternating current motors, *Science*, Feb. 24, 1888.

to point out some disadvantages of the alternating system. The advantages of the system, as allowing the distribution of incandescent lights over extended areas, are so well known, that it is no more than fair that the drawbacks should be recognized, as it is by the honest investigation of every side of a case that science and industries advance. It was pointed out in the paper on motors referred to above, that the energy, being transformed, which is equal to CE, the product of the electro-motive force by the current, could be changed in two ways: supposing E is constant, we can either change the absolute value of C, or we change the position of its maximum with respect to the maximum of E. Now, if the former was what actually occurred, as we decreased the work being done, — turned out a number of lamps, for instance, — we would decrease the current; and the heating of the line wire, equal approximately to $\frac{C_0^2}{2} R$, would decrease in a still greater proportion. But this is not what really occurs. We have only a partial decrease of current, the total decrease being partly made up by a shift of the position of the curve representing C. It was pointed out that this was a disadvantage, as the heating of the line was independent of the *position* of the current curve, depending simply on its *value*. There is another disadvantage in this, which was not mentioned in the paper referred to. A dynamo cannot carry more than a certain current, corresponding to its maximum capacity. Now, if there were absolutely no change in the *value* of the current from full load to no load, it would mean that all of the dynamos in the station would have to be run all the time; for, if we distributed the current among a few of them, they would rapidly heat and burn out. It is evident that this state of affairs would be most uneconomical, since the absolute number of horse-power lost in each machine varies very little with the load, and, besides these losses, we have the depreciation and wear on the machinery. Of course, the engines, supposing there were no lamps being burned, would be doing very little work, running uneconomically. In practice we do not have this state of affairs: the current *does* decrease in value as lamps are turned out in the secondary circuits, but it *does not* decrease proportionally to the lamps turned out, and we must run more dynamos than are necessary to supply the energy required in the lamps; and this at a reduced load, and therefore at a low efficiency. There are a number of interesting points that might be brought out here, but until I have calculated the results of some experiments, and have from them some reliable data as to the magnitude of the different effects, I will not push the matter further.

From Mr. Smith's paper it would seem that the Westinghouse Company have found it best to run the converters separately; that is, not to join a number of them in parallel. Now, the objections to this are, 1st, that it does not allow the converting system to take advantage of the law of averages; and, 2d, that as each converter is only working for a limited time on full load, and as the efficiency on partial loads is not great, the total efficiency is much reduced. As for the first, it is well known that if the total number of lamps in a certain district is, say, 2,000, the maximum capacity of the station required to supply them by a direct system will be very much less, say, 1,000 lamps; this, of course, because all the houses in the district will never have all of their lamps burning at once. If, however, we wish to supply them by converters, using a converter in each house, the capacity of our converters would have to be 2,000 lamps, since any one house might have all the lamps burning on some special occasion. If we calculate the amount of gas we could burn in a month, supposing each jet were burning all the time, and compare with the amount we actually do burn, we will find that we use, perhaps, one-twentieth part of the maximum capacity of our lights. Now, a converter working at an average of one-twentieth of its capacity is not an especially economical machine.

The above considerations must interfere with the economy of the alternating system; still it must be remembered that the system is already successful in so many cases, that, in spite of these drawbacks, the field before it is immense. In Mr. Smith's paper it is especially gratifying to notice how the system has been improved, and is still being improved.

Mr. W. L. Church read a paper on 'Independent Engines for Incandescent Electric-Light Stations,' in which he pointed out, that, when the amount of energy required from an electric-lighting station varies within wide limits, it is better to have a number of small engines to drive the dynamos than one large engine. The reason evidently is, that while a large slow-speed engine is more economical than high-speed engines of smaller size, when both are working at a maximum efficiency, yet our single large engine would only be working at full load for a small part of the day, while the rest of the time it would be doing only a small part of its possible work, and its efficiency would be low. With a number of small engines, on the other hand, when our load decreases, we can shut off some of the engines and dynamos, keeping those that are left up to very nearly their maximum efficiency. Another point in favor of the small engines is, that they may be belted directly to the dynamos, thus avoiding the loss in the countershafting used with the large machine, — a loss that might amount to twenty per cent.

Among the other papers read was a very valuable one on electric motors by Dr. G. A. Liebig; while there were a number of others, all of considerable technical interest.

Pres. J. F. Morrison having declined a re-election, Mr. S. A. Duncan of Pittsburgh was unanimously elected president of the association.

Taken altogether, the meeting was the most important, both as regards attendance and the papers read, that the association has yet held.

WASHINGTON SCIENTIFIC NEWS.

Maj. J. W. Powell on Evolution in Civilized Man. — Ascertaining the Density of the Earth. — Submarine Oil-Springs in the Pacific.

Evolution in Civilized Man.

THE annual meeting of the Anthropological Society was held on Tuesday evening, March 6. Maj. J. W. Powell, the retiring president of the society, occupied the evening by reading a paper, the sixth of a series on the same subject, on the evolution of man.

In the opening portions of his address, Major Powell explained the doctrine of evolution as taught in the philosophy of Darwin and embodied in the phrases 'the survival of the fittest in the struggle for existence' and 'natural selection.' "Nature," he said, "gives more lives than she can support: there are more individuals requiring nourishment than there is food. Only those live that obtain sufficient nutriment, and only those live that find a habitat. Of the multitude of germs, some perish on the rocks, some languish in the darkness, some are drowned in the waters, and some are devoured by other living beings. A few live because they fall not upon the rocks, but are implanted in the soils; because they are not buried in the darkness, but are bathed in the sunlight; because they are not overwhelmed by deep waters, but are nourished by gentle rains; or because they are not devoured by the hungry, but dwell among the living. A few live because they are the favorites of surrounding circumstances. In the more stately phrase of the philosophy of evolution, they are 'adapted to the environment.' Evolution, or progress in life, is accomplished among animals or plants by killing the weaker, — the less favored, — and by saving the stronger and more favored. Many must be killed because there are too many, and so the best only are preserved. Those a little above the average are saved, and this is called 'natural selection.' But this general statement must be followed a little further, that its deeper significance may be grasped."

Major Powell then illustrated the operation of the law of evolution by showing the infinite variety of conditions presented by the earth as the home of living beings, some of the ways in which competition for life is carried on, and the manner in which plants become more perfect, and animals advanced. "The endeavor has been made," he said, "to show what the struggle for existence means, and the part which competition plays in biotic evolution. Competition among plants and animals is fierce, merciless, and deadly; out of competition fear and pain are born; out of competition come anger and hatred and ferocity. But it must not be forgotten that from this same competition there arise things more beautiful and lovely, — the wing of a butterfly, the plumage of the bird, and the fur of the beast; the hum of the honey-bee, the song of the nightingale, and the chatter of the squirrel. So good and evil dwell together."

Having thus characterized that competition which obtains among the plants and lower animals in the struggle for life, Major Powell continued, "It is proposed to characterize the competition which exists in the higher civilization between man and man, and to show in what respect it may be like, and in what respect it may be different from, biotic, which exists in the lower orders of creation; and for this purpose the savage and barbaric tribes of men will be neglected. Nor will the nations of early civilization be considered, but only mankind as he has obtained the highest civilization at the present time.

"In civilization, man does not compete with plants for existence. Thorns cannot drive him from fruits, husks cannot hide nutritious seeds from his eye, shells cannot defend sweet nuts from his grasp; but he speedily destroys from the face of the earth the plants which are not of the highest value for his purpose, and he plants those that are of value, and multiplies them in a marvellous manner, and by skilled culture he steadily improves their character, making the sweet sweeter, the rich richer, and the abundant more abundant.

"In the higher civilization, man does not compete with the beast for existence. There are no howling wolves or bears on our farms, there are no lions or tigers in civilized lands, and there are no serpents in our cities. All these dwell where civilization has not yet conquered its way. Civilized man has domesticated the animal: he hives the bee for its honey, he coops the bird for its eggs, he pastures the cow for her milk, and he stables the horse that his boy may ride on its back.

"In the highest civilization, the world is not crowded with human beings beyond their ability to procure sustentation; for, if some hunger, it is not because of the lack of the world's food, but because of the imperfect distribution of that food to all. Men are not crowded against plants, men are not crowded against beasts, and men are not crowded against one another. The land is yet broad enough for all. The valleys are not all filled, the hillsides are not all covered. The portion of the earth that is actually cultivated and utilized to supply the wants of man is very small: it compares with all the land as a garden to a plain, an orchard to a forest, a meadow to a prairie. Nature is prodigal of her gifts. The sweet air, as it sweeps from zone to zone, is more than enough to fan every cheek; the pure water that falls from the heavens and refreshes the earth, and is again carried to the heavens on chariots of light, is more than enough to refresh all mankind; the bounteous earth, spread out in great continents, is more than enough to furnish every man a home; and the illimitable sea has wealth for man that yet has not been touched. Thus it is that in human evolution over-population is not a factor, as it is in biotic evolution.

"In the highest civilization, man does not compete with man in the struggle for existence, and thus human competition is not biotic competition. In biotic evolution the wolf devours the fawn; but on the average he devours the weakest fawn, and the strongest fawn lives to beget a fleeter race of stags; and the evolution of stag-life is accomplished by such means. But when the highwayman waylays the traveller, and there is a struggle for existence which ends in a murder, no step in human evolution is accomplished thereby.

"Again: in the higher civilization, man does not compete with man in the direct struggle for the means of existence as does the brute. In the struggle for subsistence, one ox gores another to drive him from a blade of grass, one wolf rends another to drive him from a bone. Among the animals the struggle for the means of existence is direct, rapacious, and cruel; but in civilized society man shares with his fellow-man: the poor and the unfortunate are fed at the table of charity. A maimed beast is driven from the crib, but men and women will vie with one another to serve a maimed man; and one of the highest aspirations of civilized society is to dispense generous hospitality.

"Vestiges of brutal competition still exist in the highest civilization, but they are called crimes; and, to prevent this struggle for existence, penal codes are enacted, prisons are built, and gallowses are erected. Competition in the struggle for existence is the agency by which progress is secured in plant and animal life, but competition in the struggle for existence among men is *crime* most degrading. Brute struggles with brute for life, and in the æons of time this struggle has wrought that marvellous transformation which we call the evolution of animals; but man struggles with man for existence, and murder runs riot: no step in human progress is made.

"That struggle for existence between man and man which we have considered and called crime is a struggle of one individual with another. But there is an organized struggle of bodies of men with bodies of men, which is not characterized as murder, but is designated as warfare. Here, then, we have man struggling with man on a large scale, and here it is where some of our modern writers on evolution discover the natural law of selection, — 'the survival of the fittest in the struggle for existence.' The strongest army survives in the grand average of the wars of the world.

"When armies are organized in modern civilization, the very strongest and best are selected, and the soldiers of the world are gathered from their homes in the prime of manhood and in lusty health. If there is one deformed, if there is one maimed, if there is one weaker of intellect, he is left at home to continue the stock, while the strong and the courageous are selected to be destroyed. In organized warfare the processes of natural selection are reversed: the fittest to live are killed, the fittest to die are preserved; and in the grand average the weak, physically, mentally, and morally, are selected to become the propagators of the race."

After illustrating this point at some length, Major Powell said that it must now be shown what man has done with this law of evolution.

"A river has a precipice in its course, and where the water falls there is danger to man. The Indian, drifting in his canoe too near to the brink, is carried over the cataract, and his bones are left to bleach upon the rocks below. But at the same place the civilized man finds a power, and about the cataract he builds a city, and with the cataract he runs his mills and factories, and that which was a power of destruction to the savage is a beneficent agent in civilization.

"Two summers ago a young friend of mine, with two comrades, was sailing a boat on Yellowstone Lake. As he neared the shore, a little cloud spread overhead; then something happened that the members of the party knew not, for it came as an instant flash. Some time after the flash of unconsciousness, my friend, who was the leader of the party and the captain of the boat, opened his eyes once more to the light of day, and the sail of his little boat was all ablaze, and the mast was on fire, and a hole had been pierced in the bottom of his boat, and the waters of the lake were boiling up to fill it, and the gunwales of the boat were sinking down to the water's edge, and before him in the boat were two prostrate forms, — one paralyzed by the lightning-stroke, and the other dead from the lightning-stroke, — and he himself had his right arm seared by the terrible bolt; and the boat sank, but in shallow water; and the living struggled out to land, and the maimed buried the dead on the shores of the lake in the land of the beautiful. How terrible is the lightning-stroke! I had another friend whose daughter was stricken with dire disease, and the wife and mother started with the invalid daughter to go beyond the seas, hoping that the mild breezes of the Mediterranean might waft the balm of healing to the loved one while she dwelt on Italian shores; but as the loved ones sailed away, and were lost behind the curve of the world, a great fear came over the heart of my friend that his loved daughter would not live to reach the farther land. Day by day the fear grew; but one day a flash of lightning came from beyond the sea through the ocean depths, and brought him a message of their safety. So the genius of man has transformed the very lightning of destruction into a messenger of love and joy.

"It is in the same manner that the genius of man has transformed this brutal, this cruel law of evolution into a beneficent agency for his own improvement; and to explain this is our delightful task.

"From the dawn of human culture in savagery, to the mid-day of culture in civilization, human genius has been producing many inventions for many purposes, and the good have given place to the better, and the better have yielded to the best.

"A sheep gathers the grass with his teeth, the ox with his tongue, and the horse with his lips; and teeth, tongues, and lips are modified and developed as these animals struggle for existence. But the savage, just a little higher than the brute, walks through natural meadows, and, with a stick in one hand, beats the grain from the stalks of grass into a basket held in the other; then, to separate the grain from the chaff, he tosses it on a tray, that the passing breeze may cleanse it; then the grain is roasted, and ground between stones, one lying on the ground, and another held in the hands, — two mealing-stones; and the flour is spread on a stone, and baked into a cake on the coals. So stick and basket and tray and mealing-stones and baking-stone are the implements and devices for gathering and preparing the cereal food of the savage. Then man invents a reaping-hook, then a grain-cradle, then a reaper; and in the process of invention from the sickle to the reaper, what a multitude of inventions are developed! Along this course how many tools, implements, and machines become obsolete and useless, that the one great reaper may remain! Here it is that we have 'the survival of the fittest in the struggle for existence;' and man, by his genius, transfers this struggle from himself to the work of his hands. The way from basket-reaping to power-reaping is long, but all the steps that way have been taken in the endeavor of mankind to secure greater happiness."

Major Powell also illustrated the evolution of the power-thresher from the flail, of the most improved winnowing-machine from the fanning-tray, of the steam or water power flouring-mill from the mealing-stones, etc.

"The sheep, the ox, and the horse make their struggle for existence with teeth, tongue, and lips; but mankind has passed beyond the stage where he must struggle for existence, into that condition where he endeavors to secure greater happiness. Tongue, teeth, and lips are no longer developed along the line of animal evolution; but human evolution is established by the development of human arts, and this struggle for existence is transferred to painless objects."

This truth was further illustrated by describing the evolution of the chronometer from the clepsydra and the hour-glass, and of the ocean steamship from the raft.

"Among bi-sexual animals, one of the agencies of evolution is sexual selection. Brutes fight with one another for mates, and in the grand aggregate the weaker are killed, and the stronger are preserved to perpetuate their kind; and various devices are gradually developed for attracting and winning mates, and the forms, colors, and habits of animals are modified thereby. But even in savagery this battle for sexual love is largely avoided, and, that peace may be preserved, marriage institutions are established. It seems at first that men in groups agree to marry women in groups. A group of men holding a group of women in common, defend one another's rights from violation from without, and live together in peace. On this plan there supervenes another system of institutions for marriage, where a group of men are destined to become husbands of a group of women in severalty, and the selections are not made by the parties themselves, but by the elders; that is, where marriage is by legal appointment within prescribed groups. Thus marriage institutions change from age to age, and from state of culture to state of culture, until the highest civilization is reached, where the man marries the woman of his choice on the sole condition that he is the man of her choice, and where the man must have but one wife, and the woman but one husband, and the twain are one in love, in purpose, and in law. But in the course of this evolution of marriage institutions, how many customs have obtained, how many agreements have been made, how many laws have been enacted! And along the entire course of the history of marriage institutions, customs and laws have disappeared, that new and better customs and laws might take their places; and the struggle for mates existing among the lower animals has been replaced by the endeavor to secure peace and happiness in human society. Thus man has transferred the struggle for existence from himself to his institutions. The marriage ceremony of the beast with his mate is a battle with a rival: the marriage of a man with his mate is a festival of kindreds and friends. And wherever any vestige of the beastly struggle remains in human society, there crime is committed, and the course of human evolution is checked. The way from communal marriage to monogamy and personal choice is very long, but every step in it has been taken by man in his endeavor to secure greater happiness."

The evolution of institutions was further shown by the establishment of authority, the history of which was traced from the elder-right through the right of the noble, by constant and long endeavor, into the right of the representative.

"Comparing animals with men, among the brutes rights and duties are distributed by hoofs and claws and horns and fangs, and by all brutal powers; but among men rights and duties are distributed by institutions.

"In this brief review of the growth of institutions, it is observed that forms of government are ever changing, that the constitution of the State is ever changing, and that the laws are ever changing. As these changes proceed, better institutions are selected by men; and thus is secured a 'survival of the fittest in the struggle for existence' among institutions. In civilization man does not struggle with man for existence; but by the invention of institutions he emancipates himself from the reign of terror inherent in brutal competition, and transfers the struggle from himself to the institutions of his creation.

"All of this statement may be summarized in this manner: man does not compete with plants and animals for existence, for he emancipates himself from that struggle by the invention of arts; and, again, man does not compete with his fellow-man for existence, for he emancipates himself from that brutal struggle by the invention of institutions. Animal evolution arises out of the struggle for existence; human evolution arises out of the endeavor to secure happiness: it is a conscious effort for improvement in condition.

"But arts and institutions alone have not secured the evolution of mankind, for they have been powerfully aided by two other classes of human invention, — namely, linguistics and opinions, — and the part which they have taken must be mentioned."

Major Powell then showed that the same struggle for existence, and the same survival of the fittest by human selection, which have been found among inventions, and again among institutions, may be discovered among languages and linguistic methods and devices.

"By human endeavor, man has created speech, by which he may express his thoughts. And out of this endeavor, in all lands and in all time, the unorganized languages of savages have been developed into the languages of modern civilization; and all this progress, all this evolution, is by human endeavor; and in it natural selection, as that term is understood in biology, has played no part.

"Along the course of human progress opinions have been changing. The cruelty of nature in biotic evolution has been set forth. In this figure of speech, Nature is personified, and, if we still personify Nature, to the savage man Nature was ever a deceiver and a cheat.

"Nature tells the savage that the earth is flat, over which the sky is arched as a solid dome; then Nature tells the savage that the sun travels over the flat earth, and under the sky of ice, by day from east to west, and returns again in a cave by night from west to east; then Nature tells the savage that the rain comes from the melting of the ice of the sky. Many, strange, foolish, and false are the stories that Nature tells to the untutored savage. Nature is the Gulliver of Gullivers, the Munchausen of Munchausens. Nature teaches men to believe in wizards and in ghosts. Nature fills the human mind with foolish superstitions and horrible beliefs. The opinions of the natural man fill him with many fears, give him many pains, and cause him to commit many crimes. Out of all these savage superstitions, man has travelled a long way into the light of science. And how shall the opinions of modern civilization be characterized? And who can tell how the knowledge of the highest civilization transcends the knowledge of the lowest savagery? And so opinions have been changing, — old opinions have died, and new opinions have been born, — and philosophies have struggled for existence as man has endeavored to learn; and with man forever the struggle to know has been the endeavor to secure happiness, for truth is good, and wisdom is joy.

"Attention has already been called to the fact that among the lowest forms of life there exists a marvellous rate of reproduction. As life advances, and plants and animals are developed, the powers of reproduction are curtailed, until man in the highest civilization, and in the highest culture of that civilization, is reached, when the rate of reproduction is at a minimum. In this state of culture the transfer of the struggle for existence from man to the works of his creation is completed. With this transfer there occurs another of wonderful nature. The marvellous powers of reproduction are transferred from the body of man to the soul of man, and he multiplies his intellectual creations at an amazing rate. Arts are multiplied to secure the joys of life, institutions are multiplied to secure justice, linguistics are multiplied to secure mental communication, and multiplied truths are discovered, so that the body of science is expanding towards the infinite and towards the infinitesimal.

"Among the lower animals the law of exercise is potent: the organ which is used is developed; disuse leads to weakness, decay, and ultimate loss. In human evolution the same method of progress by exercise is discovered to be one of the important factors.

"Through the inventions of mankind his mind has been developed. If we review the history of the human race, and fully comprehend what mental effort has been put forth to invent the arts of civilization and all the arts that have passed away by being superseded from age to age by better inventions, and fully grasp the mental efforts involved therein, we may comprehend that there is some good reason why the inventor of the electric light is superior to the inventor of the torch, why the inventor of the telegraph is superior to the inventor of the smoke-signal, why the inventor of the machine-shop is superior to the inventor of the flint-factory, why the inventor of the railroad is superior to the inventor of the dog-sled, why the inventor of the newspaper is superior to the inventor of a picture-writing on a bone. It has caused some exercise to bring about all the mental evolution which these differences implied."

This exercise of the human mind was further illustrated in the organization and re-organization of States, the enactment of laws to take the places of those that have been repealed, and in the establishment of courts. "To invent and apply human institutions, the mind of man has been forever at work, and out of this exercise has come a share of the evolution of the human intellect.

"Modern industries have been highly differentiated, or, the political economists would say, in modern industry there is great division of labor. By this division of labor men are made interdependent. No man lives for himself, but every man lives for others.

"When a man invents a new thresher, it is not that he may thresh his own grain, but that his neighbors may use it, that all the world may have it, and they, in return, may contribute to his happiness. If a man invents a new regulation or law, it is not that his own conduct may be regulated thereby, but that some injustice may be removed, or some justice be established, in the relations of the people of the State one to another. The farmer plants a field to raise wheat for his neighbors' bread, the gardener plants the vineyard to raise grapes for his neighbors' wine, the lawyer pleads his neighbors' cause, the physician gives nepenthe to his neighbors' pain, the poet writes for his neighbors' delight, the artist paints for his neighbors' gallery, and the philosopher expounds for his neighbors' instruction.

"All honest men are working for other men. If a man works exclusively for himself, he is a counterfeiter, or a forger, or a sneak-thief, or perchance a highwayman. All love of industry, all love of integrity, all love of kindred, all love of neighbor, all love of country, and all love of humanity, is expressed in labor for others. For this service thus performed a right to a reward is required, and he for whom the service is performed has imposed upon him the duty to render the reward, and the service is rendered in the hope of the reward. Everywhere in civilized society men are thus working for others. Every man, in all the years of his labor, toils for his fellow-man, and the practice is universal among all honest civilized men, and lasts from generation to generation; and universal practice is gradually becoming crystallized into universal habit. One man is trying to make better houses for his neighbors, another man is trying to make better shoes for his neighbors, another man is trying to make better laws for his neighbors, and another man is trying to make better books for his neighbors. Every man is thus forever dwelling upon the welfare of his neighbors, and making his best endeavor for their good; and thus the habit grows from generation to generation, until at last some men forget that there is reward for service, and labor for their fellow-men because they love their fellow-men.

"It has been seen that no man works for himself. The counterpart of this is that every man is dependent upon his fellow-man. That he may have good and abundant food, he desires the welfare of the farmer; that he may have good clothing, he desires the welfare of the manufacturer; that his rights may be maintained, he desires the welfare of the statesman, the jurist, and the administrator; that he may have the truth, he desires the welfare of the author; that he may enjoy poetry, he desires the welfare of the poet; and that he may enjoy art, he desires the welfare of the artist. It is thus that man is taught that he who loves the world loves himself, and he who hates the world hates himself. So it is that man toils for others and plans for their welfare, and others toil for him and plan for his welfare; so that every man's good is bound up with every other man's good, and every man's evil is an evil to every other man. And as man forever desires the good of his neighbor for his own sake, from generation to generation the desire for his neighbor's welfare for his own sake gradually becomes the desire for his neighbor's welfare for his neighbor's sake. Thus it is that selfishness is transformed into love, and justice and love are developed into the ethics of mankind. A part of the endeavor of mankind is governed by the principles of political economy, but the greater part is governed by the principles of philanthropy."

Major Powell then discussed competition among civilized men, which differs altogether from that competition which obtains among plants and animals. "It is a rivalry among men engaged in the same vocation to render a service to others that the reward may be received. Economic competition has or may have two factors, — emulation and antagonism. By emulation is meant the strife between men for greater excellence, — to perform better service for their fellow-men. By antagonism is meant strife in which man endeavors to injure his rival that he may himself succeed. Emulative competition results in human progress: antagonistic competition results in human retrogression."

The difference between these two kinds of competition was illustrated by the strife of artists to make the best pictures, by the organization of leagues or schools to instruct one another, and by such an appreciation of common interest in art as leads to great mutual help, and a comradeship that inspires to best endeavors. "Such generous emulation and all its products are in the line of human progress. But jealousies, unjust criticism, carping detraction, and vile slander lead to no progress among mankind. Every success in art creates among laymen an appreciation and love of art in every way beneficial to the artist himself. The natural man, in his ignorance, spurns all works of art. It is the cultured man that loves art; and the culture which brings appreciation and love of art arises from the ethical training which works of art give. In art, demand does not create supply, but supply creates demand. It is thus that the broad-minded artist rejoices in the success of his brother."

Further illustrations of emulative and antagonistic competition were drawn from the professional classes and from those engaged in agriculture. "The clientage of the latter is large and indefinite. The farmer is not striving to serve his neighbor Jones, but to serve the world. The farmers, too, are of great number; that is, there are many servants. For these reasons a farmer does not compete with his neighbor or with a number of specified or known persons, but his competition is with the whole body of farmers. For this reason, too, the spirit of antagonistic competition is never born: the competition of farmer with farmer is purely emulative."

These two kinds of competition were still further illustrated by the experience of the large body of people engaged in mining, manufacturing, and transporting industries. "Among them is both emulative and antagonistic. To avoid the evils of the latter, each class of employers is gradually organizing corporations or trusts; but by these, emulative competition is also avoided, for the managers of business enterprises no longer compete for business, but distribute business by convention. And in the same manner they repeal the law of competition in the labor market; they seek by convention to establish rates of wages. The employees in these same industries also compete with one another in two ways, — by striving to render their labor more efficient by skilled industry, and by offering to labor for smaller wages. The first method of competition is emulative, the second antagonistic. In all civilized society there is no competition so direful in its results, so degrading to mankind, as that which is produced among the employees of these classes who compete for employment by cheapening labor, for it results in overwork which is brutalizing, and in want which is brutalizing; and the abolition of this form of competition is one of the great questions of the day. To avoid the evil, these people organize labor unions, but, while these destroy antagonistic competition, they also result in the destruction of emulative competition. The great problem in industrial society to-day is to preserve competition, and destroy antagonistic competition. The professional classes have already solved the problem for themselves, and they stand aloof and deplore the struggle; but they should learn this lesson from history: that, when wrongs arise in any class of society, those wrongs must ultimately be righted; and, so long as they remain, the conflict must remain; and when the solution comes not by methods of peace, it comes by war.

"Injustice is a strange monster. Let any body of people come to see that injustice is done them in some particular, though it may be one which affects their welfare but to a limited degree: they dwell upon it, and discuss it, and paint its hideous form one to another, until the spectre of that injustice covers the heavens, and gradually to that injustice the people will attribute all their evils. If a body of laborers receive unjust reward for their toil, they will dwell upon this evil so long, so often, and kindle their passions to such a height, that they will at last attribute to the failure of receiving a modicum of reward for their toil all the evils of their own improvidence, all the evils of their own intemperance, all the evils of their own lust; and if fire and flood come, the very evils of unavoidable misfortune will be attributed to the injustice of unrequited toil. Injustice is of such a nature that it must be destroyed by society, or it will destroy society. We dare not contemplate its existence with equanimity, for 'behold, what a great fire a little matter kindleth!'"

One of the most interesting illustrations of antagonistic competition given was that which exists in advertising. "The honest system of advertising should be but a small announcement of the offer of goods for the information of those who desire to purchase, in such a manner that those who desire to purchase, may, by seeking, find. But in advertising as it now exists, exaggeration is piled on exaggeration, and falsehood is added to falsehood. The world is filled with monstrous lies, and they are thrust upon attention by every possible means. The mails are filled with them. When a man opens his mail in the morning, the letter of his friend is buried among these advertising monstrosities. They are thrust under street-doors, and they are offered you as you walk the streets. When you read the morning and evening papers, they are spread before you with typographic display, they are placed among the items you desire to read, and they are given false headings, and they begin with decoy headings. They are posted upon walls, and on the fences, and on the sidewalks, and on bulletin boards, and the barns and housetops and the fences of all the land are covered with them, and they are nailed to the tree and painted on rocks. Thus it is that the whole civilized world is placarded with lies, and the moral atmosphere of the world wreaks with the foul breath of this monster of antagonistic competition."

In closing, Major Powell briefly reviewed the history of the land question in Great Britain, the conversion of the commons in England into the estates of nobles, until people learned that wanton extravagance of life is cured by elevating the poor to a higher condition, where they speedily learn the principles of prudential reproduction; and to-day, in that land, statesmen and scholars are devising the means by which those great estates may still be distributed among the poor. He also referred to the movements of wages among the laborers in Great Britain, their reduction to the lowest pittance on the plea in justification of the sanction of the immutable law of competition. Then there arose a philosophy which sought to ameliorate the condition of the poor people by charity. Still later a new philosophy arose, which taught that the wage-fund was limited, and was sufficient to supply only a limited number of workers; and so wages were reduced still lower, to be followed by strikes and riots, which threatened the beautiful isle with anarchy. "And now," said Major Powell, "another philosopher has arisen in the world, the great Herbert Spencer; and he has discovered another fundamental principle, a major premise, — that human progress is by 'the survival of the fittest in the struggle for existence.' That the fittest may survive, the unfit must die. Then let the poor fall into deeper degradation, then let the hungry starve, then let the unfortunate perish, then let the rich and the wise and the good and the strong live and flourish and propagate the race, then let the ignorant remain in his ignorance. He who does not seek for knowledge himself is not worthy to possess knowledge; and the very children of the ignorant should remain untaught, that the sins of the fathers may be visited upon the children. Let your government cease to regulate industries, and, instead of carrying the mails, let them erect prisons; let governments discharge their state-employed teachers, and enlist more policemen. Such is the philosophy of Spencer and his adherents. And they establish journals to advocate these principles, and edit papers to advocate these principles, and they have become the most active propagandists of the day; and the millions are shouting, 'Great is philosophy, and great are the prophets of philosophy.'

"Thus it is that fundamental principles, major propositions, are discovered to justify injustice, and yet forever man is endeavoring to establish justice. How this shall be done I know not; but I have such faith in my fellow-man, such towering faith in human endeavor, such boundless faith in the genius for invention among mankind, such illimitable faith in the love of justice that forever wells up in the human heart, that I swear by the eternal truth the problem shall be solved."

Density of the Earth.

The following is an abstract of a paper read by Mr. G. W. Hill at the last meeting of the Mathematical Section of the Philosophical Society: —

The relation which, according to Boyle's law, holds between the pressure and the density of the atmosphere or a gas under a uniform temperature, is so simple, that we are naturally curious to see the results of its application to the mass of the earth. The greater difficulty of the problem over that in which Laplace's law of density is employed may recommend it to us as a mathematical exercise.

The differential equation, which is satisfied by the density, is readily obtained by uniting the general equation of hydrostatics with the partial differential equation which the potential function at interior points satisfies. By certain substitutions the question is reduced to the integration of a differential equation of the first order and the subsequent quadrature. Unfortunately the first operation cannot be executed in finite terms, but the application of mechanical quadratures to the equation is quite easy. The differential equation defines a system of plane curves readily constructed by drawing their tangents at points suitably distributed. These curves fall into three groups, of which one takes up the space to the right of the vertical axis of co-ordinates, and is the only one applicable to the physical question under consideration.

A first illustration of the general theory is afforded by treating the density of the atmosphere considered as surrounding a spherical earth, in which one does not neglect, as usual, the attraction of the atmosphere on itself.

Passing to the problem afforded by the mass of the earth, the construction of a single one of the formerly mentioned group of planes, and the summing of a definite integral along its line, is seen to contain the solution of the whole matter.

A general table is then formed, from which we can obtain all the data needed for applying the general theory to any particular case.

Assuming the surface density as 2.7, and the mean density as 5.67, the density at the centre comes out 21.7, and at half the surface radius 9.4.

If the mean density is more than fifteen-fourths the surface density, there is no solution.

If the mean density is exactly three times that at the surface, the number of solutions is infinite.

For the case of the earth considered above, there is only one solution.

Submarine Oil-Springs.

The Hydrographic Office publishes upon the Pilot Chart for March some late information concerning submarine oil-springs on the Pacific coast. The best known of these is off what is known as 'Coal-Oil Point,' about one and one-fourth miles west of Goleta, and ten miles west of Santa Barbara. Captain Van Helmes, of the American steamship 'Los Angeles,' says that when a vessel passes through this region the smell of the oil is so strong as frequently to cause nausea among passengers and crew, and in certain spots the oil can be distinctly seen bubbling up on the surface. Captain Wallace, of the American steamship 'City of Chester,' has also seen oil floating on the water to the north of Cape Mendocino, from three to five miles off shore, and thinks there is another spring there. Captain Plummer, of the American steamship 'Gipsy,' says the belt of oil above Santa Barbara can be seen on the darkest night when sailing through it. Captain Goodall, of the Pacific Steamship Company, says of the region off Coal-Oil Point, that on a calm day the water is covered for miles with oil, bubbles of which can be seen rising to the surface and spreading over it. Although it does not seem to smooth the water like animal oil, yet, on a windy day, one can see a smooth slick of oil on the surface. This spot is so well known by shipmasters, that the smell of the oil is used as a guide in foggy weather, the petroleum smell being so strong that a captain can never mistake his position when off that point. Captain Goodall says, also, that he has noticed a small flow of oil from the bottom of the sea off Cojo Point, near Point Conception, but there the amount of oil is very small. It cannot be seen bubbling from the bottom, but is often visible on the surface, the odor being very perceptible.

HEALTH MATTERS.

Scarlet-Fever.

THE following striking instance, illustrating the communicability of scarlet-fever, is sent us by Dr. George E. Goodfellow of Tombstone, Arizona, in answer to the letter of inquiry sent by *Science* some months ago: —

"I came to Prescott, Arizona, in 1876. At that time I was informed by physicians residing there for a number of years, that, to their knowledge, no case of scarlet-fever ever had been known either in the town or surrounding country. Prescott is a pleasant little mountain town of central Arizona, and at that time had a population of about eighteen hundred, and had been then, and is now, considered to be unusually free from disease. The altitude is about 5,800 feet. There was no sewerage system, nor was one needed. In this climate of the South-West, owing to the dryness of the atmosphere, excrementitious material desiccates so rapidly, and the residents are so unaccustomed to the vile odors of civilization, that they never have realized the necessity of supplying the pabulum of putrefaction, in the shape of water, to their sewage. There was not a foul-smelling outhouse in the town, save around the saloons and some restaurants; and there, be it noted, no one lived; neither was any one there, taken sick in the epidemic, to be recounted. I speak thus authoritatively of the condition of the village, for I was appointed health-officer, therefore knew the state of things. One more preliminary statement. Of the people living in Prescott and the encompassing neighborhood, almost all were considered as old residents; that is, they had emigrated to Arizona about 1862–64, mostly from the Pacific coast. There was comparatively little immigration into the Territory from 1868 to 1876–77. By reason of this, the children imported from California left that State before the advent there extensively of scarlet-fever and kindred diseases, and were now grown to manhood and womanhood without ever having had any of the contagious diseases of childhood. Many of these, particularly the girls, were married and had children; and it was among these children that the disease which proved so fatal started. Whatever the differences of opinion concerning the first cases, which made their appearance in May or June, 1877, the nature and malignancy of the fever were soon conceded by even the most sceptical. It was scarlet-fever in its most malignant form, and, if I recollect aright, it swept away between twenty and thirty children in that small burg before it ceased. But it was not confined to the children: the parents, particularly the young mothers, as described above, contracted the fever in all grades of severity, though usually in a mild form. There was a family, prominent in the place, with three children, aged from two to eight. I was the medical attendant. The eldest contracted the disease first, and in a few days the others had it. Two of them died about the seventh day, — the two younger ones. The other ultimately recovered. Owing to the popularity of the family, a large number of visitors, sympathizing friends, and curious neighbors, as is usual in small towns, had filled the place, spite of all protests from the physician, from the beginning of the trouble until the sad ending. Of the immediate friends, a large number were of the younger class heretofore described, that never had had scarlet-fever. Of these, the majority were taken down with some form of sickness related to the disease. Most of them had the fever outright, but some only had severe sore throats. The father, mother, consulting physician, and myself were all attacked. Whether I ever had had the fever, I do not know. The father, two young men, and myself, who had been closely in contact with the children from the beginning of their illness, lay at the point of death for some days; and, of all who were in the house, not one escaped without some manifestation of the disease. Thus effectually was the fever spread. It seems to me this is a striking illustration of the communicability of the disease. Of course, the objection may be raised, the sanitary conditions of the house were not good. But they were. The house was a new one, a year old, of wood, set up from the ground by short two-by-four scantling, so that the wind had an elegant chance to ventilate the building. There was no cesspool, or foul locus of any sort, in the neighborhood. It was, in fact, an ideally clean place. Some of those who had typical cases of the fever were twenty-four and twenty-five years of age.

"Now, here was an epidemic, which, so far as we knew at the beginning, had no antecedent case to initiate it. My subsequent investigations settled that point. It was ascertained that the previous year, at Fort Whipple, an army post near the edge of town, there had been some cases of what the post surgeon pronounced scarlet-fever. Thus died the case of the *de novo*ites. At any rate, the *onus probandi* of origin was put on the preceding year's cases. Where they came from, never was shown certainly; but as some families had recently joined the station, coming from infected points, it was a natural supposition to conclude that they brought it with them. This is the strongest concatenation of circumstances, derived from personal observation, I can give. I have not entered into details showing absence of other sources of contagion in the persons attacked. This must be assumed as having been established at the time."

VACCINATION STATISTICS. — The following extract from *The Sanitarian* would seem to indicate that a compulsory vaccination law has its advantages: "The success of the anti-vaccinationists is aptly shown by the results in Zurich, Switzerland, where for a number of years, until 1883, a compulsory vaccination law obtained, and small-pox was wholly prevented (not a single case occurred in 1882). This result was seized upon in the following year by the anti-vaccinationists, and used against the necessity for any such law, and it seems they had sufficient influence to cause its repeal. The death returns for that year (1883) showed that for every thousand deaths two were caused by small-pox; in 1884, there were three; in 1885, seventeen; and in the first quarter of 1886, eighty-five."

BLOOD-CHANGES. — The Paris correspondent of the *New York Medical Journal* says that the application of spectroscopy to the study of pathological alterations in the blood is receiving considerable attention in that city. So far, the considerable expense of the large instruments employed has to a great extent prevented any use being made in medicine of the principal characteristics of the coloring-matter of the blood, either in the normal or in the pathological state; but a late invention of Dr. Hénocque's places in the hands of the medical profession a handy, portable hæmato-spectroscope, that will almost go into a waistcoat pocket, and with which a spectral analysis, both qualitative and quantitative, of hæmoglobin and its derivatives (oxyhæmoglobin, methæmoglobin, etc.), can be made at the bedside. But it will be asked, What is the advantage of knowing this? Well, it has been proved to be of the utmost importance in the study of the variations of the activity of the reduction of oxyhæmoglobin in health and in disease. This Dr. Hénocque makes us *see* with his instrument applied to the thumb. A small elastic-band ligature is tied around the lower part of the thumb, and on the hæmatoscope being applied to the nail, which is exposed to the usual daylight (as strong as possible, but that from a house-window is enough), the energy of the exchange going on between oxygen and the tissues can be seen. This new idea is of great practical importance in the study of the phenomena of nutrition, both in physiological and in pathological states; so that such physicians as Professor Germain Sée are now taking the matter up and applying it to the study of many pathological states, such as anæmia, etc. Dr. Hénocque is one of Professor Brown-Séquard's best men. He has given the results of some three hundred and seventy cases in which experiments were made.

BOOK-REVIEWS.

Proceedings of the American Society for Psychical Research. Vol. i. No. 3, 1887.

THE appearance of Miss Fletcher's paper upon 'The Supernatural among the Omaha Tribe of Indians,' in the Proceedings of the Psychic Research Society, is of importance, because it shows that this society is in part ready to take the anthropological view of such notions, to find their interest in the recording of such popular beliefs as a contribution to the statistics of human thought with no more reference to their possible objective verification than is necessary to shed light upon their origin. Apart from this, Miss Fletcher's paper is extremely interesting as showing the naturalness with which the supernatural enters into the every-day life of unenlightened people. It is also noteworthy that the Omaha ghost lets himself be heard so much more than seen, while with us the reverse is the case. This fact is very suggestive, and several aids to an explanation present themselves. It is also worth mentioning how little the evolution of terror is associated with the 'ghost-noises' of the Omahas.

All those who have followed the eventful career of the 'Phantasms of the Living' — the depository of the work of the English Psychic Research Society — will read with interest the controversy between Mr. C. S. Peirce, the well-known mathematician and logician, and Mr. Edmund Gurney. The former makes a detailed enumeration of all such cases regarded by Mr. Gurney and his associates as a proof of spontaneous telepathy, and shows that a large proportion of these suffer from serious omissions and fallacies, mainly sinning against the principles of the logic of induction. This brings a lengthy reply from Mr. Gurney, and a still longer rejoinder from Mr. Peirce. The discussion turns upon details, and must be read in full. Two points may be briefly noticed. The first relates to the estimation of the probability of a certain thought occurring to our minds within a given period. This is always a delicate task; and, as so much of our mental activity goes on in the region of the unconscious, it seems safer to make a very liberal estimate in this regard; and, if we do this, a larger number of coincidences of such presentiments as the death of a friend (as prompted by an undefined feeling about his welfare) with the actual occurrence will be attributable to chance. It is through the neglect of this consideration that the evidential value of many of the best cases is decidedly weakened. Next, as Mr. Peirce well argues, if we admit that the cases as they stand defy explanation by ordinary reasoning, it is very easy to invent half a dozen hypotheses explaining the facts as well as does the telepathic theory, and in the minds of many people by no means as improbable as the latter.

The reports of the several committees are more than usually satisfactory. The report of the committee on thought-transferrence, apart from an injudicious closing paragraph, is a frank confession of negative results. The committee on experimental psychology, of which Dr. C. S. Minot is the chairman, give the results of their inquiries as to the prevalence of a feeling sufficiently strong to influence action with reference (1) to sitting down thirteen at table, (2) to beginning a voyage on Friday, (3) to seeing the new moon over your left shoulder. The results are, that both in men and in women the most prevalent superstition is (3); the least prevalent is (1); and that about one man in ten, and two women in ten, acknowledge a belief in these superstitions. Furthermore, the question, whether in choosing between two otherwise equally desirable houses you would be influenced by the reputation of the one as haunted, is answered in the affirmative by forty-four men and sixty-six women in one hundred; but it should be added that a large number place this choice on accessory grounds, and not on the hauntedness of the house. Whether these statistics will be taken as marking the prevalence of frankness or of real superstition, must be left for each to decide.

The reports on haunted houses and on mediumistic phenomena presents few points of interest. The opposite is true of Mr. Cory's admirable observations on hypnotic phenomena. Only a single observation of the many ingenious tests devised by Mr. Cory can here be given. The fact that some hypnotic subjects can associate a suggested hallucination with a blank card, is explained by supposing that some trifling irregularity on the card serves to their hypersensitive senses as the direct excitant of the hallucination. This Mr. Cory supports, and really proves. A pencil with one end slightly nicked is placed on end on a mantel, and the subject is given the suggestion that nothing is upon the mantel. Then eleven other precisely similar pencils are placed on the mantel, when the subject is asked to count them, and counts eleven. A strip of board is so held as to cover the nick on the one pencil, and under this condition the subject counts twelve, showing that the sight of the nick sets the mind so as not to count that pencil.

This valuable number of the Proceedings is concluded with two notes from the pen of Prof. William James. In the first, Professor James gives the results of experiments upon the 're-action time' in the hypnotic state; showing that it is at times longer, and at times shorter, than in the normal state, and that a more detailed analysis of the kind of hypnosis is necessary to explain these results. The other brings together a number of important facts concerning the 'consciousness of lost limbs.'

LETTERS TO THE EDITOR.

**** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

Twenty copies of the number containing his communication will be furnished free to any correspondent on request.

The editor will be glad to publish any queries consonant with the character of the journal.

Diamonds in Meteorites.

ON Sept. 4, 1886, a meteoric stone weighing about four pounds fell at Novy Urej, Krasnoslobodsk, in the Government of Penza, Siberia. In this MM. Latchinoff and Jorefeif found what they supposed to be diamonds of microscopic size. In an insoluble residue small corpuscles, showing traces of polarization, were harder than corundum, and having the density and other characteristics of the diamond, and were present to the amount of one per cent of the whole mass (see *Nature*, Dec. 1, 1887). Through the courtesy of his Excellency Julien V. Siemaschko of St. Petersburg, I have been able to procure a small piece of the meteorite. Mr. H. Hensoldt, section-cutter at the School of Mines, very kindly prepared sections of the same, which I found to contain metallic iron in small thin plates, magnetite in small opaque grains, a plagioclase felspar, and olivine in oval grains, but was unable to detect any of these bodies in the sections. Prof. H. Carvill Lewis, to whom I sent the material, informed me that he had extracted two small oval bodies, almost isotropic, and showing no more traces of polarization than occur in many diamonds. With some other fragments of the meteorite, and not with these, he made two good scratches on a polished sapphire. He did not mount the crystals, because they were again lost: so I could not examine them. He was, however, inclined to support the views of the describers.

I found, that, by grinding with a sapphire four particles of the meteorite, I distinctly made a number of minute but deep scratches on each polished face of four different sapphires with each piece of meteorite. These scratches are characteristic of but one mineral that we know, and that is the diamond; but they are evidently so minute, that they form a coating or an aggregate over the other minerals, and were too small to distinguish, but yet exist in quantity, and may also possibly be the amorphous form of the diamond known as carbon or carbonado (?) Small pieces of the meteorite were then boiled for some time in hydrochloric, sulphuric, and nitro-muriatic acids. This readily removed all of the iron and magnetite, leaving only the skeletons of olivine, on which were small black particles, one of which was elongated but rounded, suggesting two joined cubes(?) On crushing one of these olivine pieces with black crystals attached, and grinding it with a polished sapphire, it readily scratched the same. If a larger quantity of material comes to hand, the writer will have polished a diamond with the powder of the meteorite, using a new wheel for the purpose. The writer has not seen the paper of MM. Latchinoff and Jorefeif, but there seems to be every reason to substantiate their conclusions.

These facts are of especial interest, since on Jan. 15, 1887, Prof. L. Fletcher, curator of the Mineralogical Department of the British Museum, read before the Mineralogical Society of England a paper on a meteorite which was found in the sub-district of Youndegin, Australia, in 1884, and in which he stated he had found a new form of graphite of cubic form, with the hardness of 2.5 and a specific gravity of 2.12. To this he gave the name of 'cliftonite,' calling attention, also, to the fact that Haidinger, in 1846, had found what he described as graphite pseudomorph after iron pyrites (*Poggendorf Annalen*, 1846, lxvii. p. 437), obtained by him from a nodule of graphite which had dropped out of the Arva meteorite. Gustav Rose (*Beschreibung und Entheilung der Meteoriten*, 1864, p. 40; *Poggendorf Annalen*, 1873) expressed an opinion that this mode of replacement of the cube edges on these crystals was suggestive of holo-symmetry rather than hemi-symmetry, and that this interpretation would exclude iron pyrites as a possible antecedent mineral.

The cliftonite was readily examined with a ⅛-inch objective; and from its structure Professor Fletcher concluded, that, while it is different from native graphite, the sharpness, separateness, and completeness of the crystal, the brightness of the faces, the delicacy of the acicular projections, and especially of the obtuse, almost flat, square pyramids, or some of the faces, are quite sufficient to prove that the form has never had any other than its present tenants; in other words, that it is not a pseudomorph. When in cubes, the diamond has faces not very unlike those of the Youndegin crystals, and shows a similar bevelling of its edges by the rounded tetrahexedra. Again: Professor Fletcher says it might be argued, that, during a hurried crystallization of the carbon, circumstances initially favorable to the formation of the diamond had finally permitted the existence of carbon in a graphitic form only. He had also found distinct graphitic crystals, cube octahedrous in form, in the Cocke and Sevier County (Tenn.) meteorites.

When we consider that only a few meteorites have been examined for this mineral, we have reason to expect some interesting results in the future. GEORGE F. KUNZ.

New York, March 6.

A Pseudo-Meteorite.

THROUGH the kindness of Dr. DeWitt Webb of St. Augustine, Fla., I have been able to examine a portion of the so-called 'meteoric stone,' weighing over two hundred pounds, which was said to have been seen to fall in an old cultivated field near Middleburgh, Clay County, Fla., and which was exhibited at the Subtropical Exposition at Jacksonville, Fla. It is a concretionary limonite, and not of meteoric origin. GEORGE F. KUNZ.

New York, March 6.

Monocular vs. Binocular Vision.

AS a constant student of binocular phenomena, I have been much interested in Mr. Hyslop's letter in *Science* of Feb. 10. I have repeated the experiment illustrated by his Fig. 1, and confirmed his results. But I do not think they are to be explained by any supposed struggle between monocular and binocular vision, but in a far more obvious way, which, in fact, he himself suggests.

In binocular combination of such simple figures as circles, where the means of estimating distance is reduced to ocular convergence alone, the estimate is very imperfect and uncertain. Our knowledge so interferes with our visual judgment that we are apt to over-estimate the distance. In fact, many persons even find a difficulty in seeing the combined binocular image any nearer than the two monocular images. As long as attention is fixed on the combined circle, the homogeneous image of the needle will seem beyond, as it ought. This will be much more distinct if we range the point of sight back and forth, combining successively the needle-points and the circles. But when we transfer attention wholly to the double images of the needle, these latter will sometimes appear nearer than the circle; not, however, because the needle seems nearer than before, but because the circle drops to the plane of the paper, where it tends to go, anyhow.

The experiment illustrated by his second figure I cannot confirm. It is true that experiment with his figures as drawn in *Science* confirms his results, but this is only because the figures are badly drawn. The positions of the two small circles b and c are not symmetrical. When accurately drawn, I find, on combining, that the small circle and the large circle appear exactly on the same plane. My son, aged eighteen, and well practised in binocular experiments, confirms my results perfectly. Whether Mr. Hyslop's original figures were imperfect, or have been only badly copied, I know not; but the wonderful distinctness with which binocular combination will bring out and exaggerate the smallest differences in apparently similar figures, is well known.

JOSEPH LECONTE.

Berkeley, Cal., Feb. 22.

The Scientific Swindler Again.

THE following from the *Indianapolis Journal* of Feb. 24 may be of interest to those who have been the victims of the swindler so extensively advertised by your own and other journals: "The book-thief who has, under the names of W. R. Taggart, Professor Cameron, Professor Douglass, and various *aliases*, travelled over the country, representing himself as a scientific student, and borrowing valuable books, has been arrested in Cincinnati, where he gave the name of Otto Syrski. He was recognized yesterday by Professor Collett of this city, who was one of his victims. Professor Collet learned where his books had been sold, and will probably recover them." It is to be hoped that this will stop his operations, at least for a time. A. W. BUTLER.

Brookville, Ind., March 1.

A Critique of Psycho-Physic Methods.

DR. JOSEPH JASTROW, in the second number of the *Journal of Psychology*, discusses the principal psycho-physic methods now in use, and advocates a thorough reform of the science of psychophysics. One of the principal conclusions at which he arrives is that no such thing as a differential threshold exists; that is to say, that there is no definite point at which the difference of two sensations ceases to be perceptible. Dr. Jastrow's arguments fail to convince us. He says, "The threshold is described as a point not exactly constant, but nearly so: above it all differences can be felt, below it all differences vanish into unconsciousness. No matter whether little or much below this point, they are utterly lost. It is idle to say, as Fechner at times does, that they differ in the amount of additional stimulation necessary to bring them up into consciousness, unless you mean that the series below the so-called threshold is an exact continuation of the series above it; and, if you do mean this, then the threshold loses all its distinguishing peculiarities, and ceases to exist." Further on, in discussing the theory of the right and wrong cases, he says, "It has been proved that the ratio of wrong answers increases as the difference between the stimuli decreases; but the 'threshold theory' claims that this last fails to hold after this difference has been diminished below a certain ratio."

In considering these objections, I may be allowed to treat two classes of sensations separately: first, the judgment that a difference exists is based on a sudden change in the character of the sensation either in space or time; second, the judgment refers to sensations separate in space or time or in both. As an example of the former, we may assume two adjoining fields of various colors or various intensities of light, or a sound suddenly increasing in intensity or height. The threshold theory says there is a certain difference between these adjoining sensations below which no difference will be perceived. Practically this is admitted by Jastrow. In trying to meet such an argument, he first says that there exists only an average threshold; i.e., the average smallest perceptible proportion of intensity or wave-length of the two sensations on which the observer is able to form a judgment. He continues, "Here you either (1) tacitly assume that not many observations are to be taken, or that (2) no matter how many observations were made, no mistake would ever occur."

The arguments of the advocates of the threshold heory are somewhat different from what Jastrow would make us believe. In the first class of sensations there are two reasons for the existence of a threshold, — a physiological and a psychological. As a balance has a certain limit of accuracy beyond which it does not show differences of weight of two bodies, so our organs of sensation are not able to show differences between stimuli varying only to a very small extent. This is the physiological threshold. But, besides, the advocate of the threshold theory says it is necessary that the sensations should differ to a certain degree, else they cannot be distinguished. He does not say, however, as Jastrow assumes, that the magnitude of this least perceptible difference is the same at any moment. On the contrary, it depends on the state of mind of the person, and varies just as Jastrow's sensibility varies, every moment having its own threshold, the average of which is the average threshold of the observer.

The theory of the threshold may be summed up in the following remarks: —

Two sensations are given, the difference of which is to be judged upon. The judgment can have various characteristics. Either a certain phenomenon is observed which has no immediate connection with the sensations to be compared (for instance, the line dividing two fields of various colors is observed), or the sensations are separate in space and time. In this case the conception of the former is compared with the latter sensation. In the former case the physiological threshold is the main consideration, and for this reason it may be omitted in these brief remarks.

In the latter case let the sensations S_1 and S_2 be given, which are produced by the stimuli s_1 and s_2. Let S_1 be the first to be observed. In making the comparison, S_1 will not be correctly remembered; but the probability that another and similar sensation, S_x, which would correspond to the stimulus s_x, is produced, will be

$$W_{S_x} = f(s_x, s_1, C)\, ds,$$

the constant depending upon the conditions of the experiment.

Experiments show that W increases when the difference between s_1 and s_x decreases. Further experiments show that when the two stimuli s_1 and s_2 differ but slightly, in a great number of cases the observer will judge $S_1 = S_2$. According to the theory of probability, W_{S_2} is only very small as compared to all other possible reproductions. Therefore the only possible explanation of the fact that the judgment $S_1 = S_2$ is comparatively frequent, is, that not only in those instances when the conception S_2 is reproduced are both judged to be identical, but that sensations varying only slightly from S_2 cannot be distinguished from it; and the task of psycho-physic methods is to find the limits of these variations. Mathematically the number of observations in which both sensations are considered the same is expressed by the following formula: —

$$W_1 = \int_{s_2 - \delta}^{s_2 + \delta_1} f(s, s_1, C)\, ds.$$

δ_1 and δ are the upper and lower thresholds respectively. This explanation agrees exactly with the observed fact, that slightly different stimuli cannot be distinguished; and Jastrow's objections are founded on a misconception of the mathematical basis of the theory. No advocate of the threshold theory assumes, as Jastrow supposes, that below the threshold the probability of a greater error is the same as that of a smaller error.

In another passage of his critique, Jastrow rejects the use of doubtful cases in the theory of right and wrong cases. It seems to me that his objections cannot be accepted. The fact is, that in a number of cases doubtful answers must be given. In his paper he says, and rightly, that the confidence is increasing with the difference of the sensations. Now, the answer 'doubtful' is nothing else than an expression of the degree of confidence; and, according to the above formula, the proper way to include these answers in the theory is to assume a second threshold which shows the limit of doubtful cases, and this has been successfully done.

It will easily be seen that variations of a sensation such as assumed by the theory outlined above always occur, and that they must prevail in all psycho-physic experiments except in the first class.

Dr. Jastrow's suggestion to measure the sensibility by psycho-physic methods is a good one. It has been successfully applied for measuring various degrees of attention, and the writer fully agrees with Dr. Jastrow's opinion that this is the most promising field of psycho-physic research. DR. FRANZ BOAS.

New York, March 1.

American and Foreign Microscopes.

MY attention having been called to the 'Complaint' in *Science* for Dec. 2, 1887, and the following articles on microscopes, the facts did not seem to me fully presented therein. I immediately addressed the following questions to more than twenty of the leading colleges of the country, the Department of Agriculture, Geological Survey, and Microscopical Society of Washington, D.C., and Messrs. Wolle and Smith, two of the oldest microscopists in the country. The results are herewith presented, with my own ideas on the subject.

The questions were, 1. How many microscopes of American make have you? [659.] 2. How many of foreign make? [434.] 3. How many without a joint? [309.] 4. Do your students work standing, or sitting? 5. Is the instrument used in an inclined position to any extent?

The figures in brackets give the sums total of the replies. Pennsylvania University reports 100 American, 3 foreign; Michigan, 120 American, 30 foreign. Of the foreign instruments, 108 belong to Harvard, and 135 to Bryn Mawr, Johns Hopkins, and Massachusetts Institute of Technology. About 40 jointed instruments are reported used in the upright position; more than two-thirds of the whole number are used inclined. To No. 4, the answer "Sitting," is almost universal; "Standing or sitting," a few. The following extracts from the replies are pertinent: —

"I prefer to work it upright, and teach my students so, but they will incline it whenever possible."

"When long at work, I prefer a vertical tube; but I find for young students the inclined position and the rack and pinion extremely desirable."

"Only by unfortunates. Of course, the joint is a convenience, but is not, in my opinion, essential." — HARVARD COLLEGE, in answer to No. 5.

"The instruments are used almost exclusively in the upright position, the tables being low enough to permit of such use with ease." — UNIVERSITY OF NEBRASKA.

"Mostly foreign instruments, generally inclined, prefer inclined; would use it inclined if I could" [of upright instruments]. — GEOLOGICAL SURVEY.

"The latest purchases are American, which are now preferred." — ALBANY.

"Personally, I believe the best instruments are made in this country." — UNIVERSITY OF MICHIGAN.

"In my laboratory (physiology and hygiene), we use forty. I bought the first in 1876, foreign because then cheaper. In four years they were all worthless. We then bought American: they have stood more rough usage, and had fewer repairs necessary, than any others. My work is especially trying on account of the frequency with which acids must be used."

"I believe the eye is more nearly in its normal and best position when the microscope is inclined." — PRINCETON.

"My constant companion at my table is Zentmayer's army microscope. Have used it twelve or more years, always inclined, or very rarely vertical." — F. WOLLE.

"Twenty-five years ago I got Powell and Lealand's stands. I seldom use their objectives. For long years I have preferred American objectives. I have recently seen letters from purchasers of Zeiss apochromatics, confessing that Spencer's most recent glasses fully hold their own, and at less prices." — H. L. SMITH.

"The facility to incline when needed is indispensable." — J. G. HUNT.

In 1862 I saw much of Dr. Hunt, then unsurpassed as a histologist. He used a Beck best, inclined, in continuous daily work. His experience assisted in the construction of the American Centennial instrument, which he has since used. This is an instance of an elaborate tool employed in actual, original, and long-continued work. After this came the Beck International, costing seventeen hundred dollars, and with the most elaborate accessories ever offered to the public, — no doubt 'brazen elephantiasis,' but not an American instrument. The latest Zeiss instruments brought to this city have just the same nickle plating and lacquer as the American; and without lacquer any instrument would be soon worthless.

In 1860 I used a French upright, then successively a Nachet best, Zentmayer, Beck small best, Popular, and in my laboratory Bausch and Lomb Model and Harvard. In 1875 I brought over a lot of Zeiss's work. I use the inclined position always, except for watch-glasses, or such large vessels. Have used fluids contantly, on tissues, in the examination of fibres according to Vetillart, and numberless examinations of urine, as well as chemical work. The capillary attraction between cover and slide is sufficient, as a rule, to hold all that is required.

I do not see that the disclaimer in the last article affects the statements made in the 'Complaint.' Histological work is the investigation of the minute structure of plants and animals, and this is just what microscopes are made and used for in this country in biological laboratories and by practising physicians. The number of amateurs is very small, and, of instruments used for petrographical and chemical work exclusively, still smaller. In the Washington society, twenty-six members are physicians, nearly all in practice, seven are teachers and investigators, and seven are amateurs.

The American stand has been developed from, and has re-acted upon, the English stand, — a different and radically better type than the German. There are probably as many microscopes made and used by English-speaking people as by all the rest of the world. A Beck was exhibited at one of the late meetings of the Washington Society numbered over 15,000. This means over that number of jointed instruments in use, of one English maker, of which about one-third are in this country. The latest Zeiss here is 11,468 (August), and all but his lowest styles have a joint.

Most English microscopes have a joint, — a feature of the Germans first despised, then condemned, and finally adopted. The jointed stand does all that the upright does, and much that the upright cannot do. The cost of the joint is about two dollars. The Zeiss stand VII, *a* and *b*, is said by Zeiss to be "especially suitable for laboratory use." It has no joint. Its stage is 67 by 72 mm., and 86 mm. high. The price, with two objectives and two eye-pieces, is $34; with another objective, $41. The Zentmayer Histological (American) was put on the market in 1876. It has a joint. Its stage is 65 by 95 mm., and 76 mm. high. With one eye-piece and two objectives and case, it costs $38 and $46. The Bausch and Lomb Harvard has a stage 85 by 90 mm., and 82 mm. high. With two objectives and two eye-pieces, the price is $43. It is well known that the discounts here are larger than on foreign catalogue prices; and in quantity these American instruments, with lower and broader stages than the foreign instruments of equal grade, can be purchased cheaper. No one is obliged to buy a slide-carrier unless wanted. It is priced separate. The glass slip stage was an American invention, was adopted by the French and English makers, and is stated by Dr. Carpenter, in his last edition, "to be the most perfect yet devised." The Iris diaphragm is not generally applied by American makers to college microscopes.

The prices of German low-power objectives are less than American, but high powers are dearer. A Zeiss $\frac{1}{12}$ costs $90, a $\frac{1}{20}$ $112 to $140, to which must be added the cost of special eye-pieces. A Spencer first-class dry $\frac{1}{16}$ costs $60, a $\frac{1}{15}$ homo immersion $80, both high angle; a professional $\frac{1}{6}$ of 175 B.A., $40. If these prices are averaged with the low powers, the American lenses are cheapest, without any regard to duty. We want three classes of microscopes, — the college, the professional, and the complete. The first may have less finish and no substage fittings, the second with substage fittings and better finish, the third with graduated circles, etc. All require a spreading tripod base, a joint, a Jackson arm sitting square on the trunnions, a firm clamp to the latter, and the arm cast solid from the axis of the swinging tail-piece to the barrel.

Our catalogues should give for each instrument the height and size of stage, and the length of barrel.

There has already been much discussion on the uniform construction of microscopes at the meetings of the American Association of Microscopists. A resolution in this direction offered by the writer last summer was ruled out on the ground that the subject was exhausted for the present. An important contribution on tube-length read at Pittsburgh by Professor Gage has already appeared in *Queen's Bulletin*, and will be published in the forthcoming Proceedings of said society.

Colleges pay no duty on their instruments: hence their selection is not affected by the tariff. As to the principle, I am an American citizen and a teacher, and, other things being equal, I prefer to buy my microscopes of my neighbor, who will send his children to my school, and who, if he grows rich making microscopes, may endow my college, rather than to send afar, to one who is not likely to be interested in my success or that of my country. I know professors of political economy do not teach this view; but most business-men act according to it, though the principle may be unwisely applied. Under it as the rule of our national polity, we have made the best and cheapest watches, telescopes, and apparatus for the investigation of radiant heat; and, if the users of microscopes will only co-operate fairly with the makers thereof, we shall soon have the best and cheapest microscopes the world has yet seen. Many who condemn protection, ask for international copyright; and one of their arguments is, that, by raising the price of foreign literature, it will make a better market for domestic productions. So it will, and tend to shut out some excellent foreign work, and is so far just as 'absurd and senseless' as the duty on microscopes.

For details on the above matters, see Harting, *Das Mikroskop*, vol. iii. p. 262; Mayall's 'Cantor Lectures;' and Hon. J. D. Cox, 'Microscopic Work,' *American Journal of Microscopy* for 1879, p. 131.

W. H. Seaman, M.D.

Howard University, Washington, D.C., Feb. 25.

Indian Wrist-Guards.

In a review of Professor Morse's 'Methods of Arrow-Release' in *Science* last year (ix. p. 122), I ventured to suggest "whether it is not possible that the so-called 'pierced tablets,' which are described and figured by Professor Rau (*Archeological Collection of the Smithsonian Institution*, p. 23) and other writers, and which have given rise to so much discussion among American antiquaries, may not have been guards worn to protect the wrist against the recoil of the bow-string." Since writing this, I have happened upon an article by R. S. Robertson, in *The American Antiquarian* (i. p. 100), in which he advances the same opinion. He says, "A short time since, when exhibiting one to an old gentleman, who was a clerk for a fur-trader, while the Miamis still occupied the region around Fort Wayne, he assured me he had often seen them in use, and that they were worn on the left wrist to ward off the blow of the bow-string in hunting." I have lately noticed statements in early descriptions of the customs of the Indians, which seem to me to lend some countenance to this view. Capt. John Smith, in his 'Map of Virginia,' p. 23 (Arber's reprint, p. 68), telling how the Indians make their bows and arrows, says, "His arrow-head he quickly maketh with a little bone, which he ever weareth at his bracer, of any splint of stone or glass in the form of a heart." Strachey, in his 'Historie of Travaile into Virginia' (Hakluyt Society edition, p. 106), employing precisely the same language, adds, "and which bracer is commonly of some beast's skin; either of the wolf, badger, or black fox." In the 'General History of Virginia,' which comprises a reprint, with additions, of 'The Map of Virginia,' Third Book, p. 15 (Arber's reprint, p. 397), in an account of the capture of Smith, we are informed that the Indians had "every one his quiver of arrows, and at his back a club; on his arm a fox or an otter's skin, or some such matter, for his vambrace."

Winslow, in 'Good Newes from New England' (Young's edition, p. 365), says, "The men wear also, when they go abroad in cold weather, an otter or fox skin on their right arm, but only their bracer on the left."

As 'bracer,' or 'vambrace,' was the common term employed by old English writers to designate armor worn upon the fore-arm, we are authorized to infer from these statements that the Indians were accustomed to make use of the skin of some animal for a similar purpose. It would seem to be a very easy transition from a piece of leather to a thin, flat tablet of stone, pierced near the centre usually with two holes, which could readily be adjusted to the wrist as a guard.

In ancient Egyptian tomb-paintings (WILKINSON'S *Ancient Egyptians*, i. p. 351), archers are depicted wearing such wrist-guards; and in the European museums it is quite common to find small, oblong, thin plates of bone or ivory, pierced with holes, which are universally regarded there as having been employed for such a purpose. HENRY W. HAYNES.

Boston, Feb. 29.

Notes on the Geology of the Cascade Range.

IN *Science* of Feb. 10, Mr. Herbert Lang discussed evidence bearing on the history of the Cascade Range in Oregon. It may be of interest in connection with Mr. Lang's conclusions to state some facts observed by the parties of the Northern Transcontinental Survey in explorations conducted in Washington Territory from 1881 to 1884.

Coal was the prime object of these surveys, and work was most thorough where it was found in greatest abundance; but the prospecting parties covered the greater part of the Cascade Range north of Mount Rainier, and the facts which follow are of my own observation unless otherwise stated.

It was found that the formations of the Cascade Range in Washington Territory are, 1. Glacial drift; 2. Tertiary eruptives; 3. Unaltered sandstones and shales containing numerous carbonaceous beds, thickness 13,000′± (Laramie?); 4. Local conglomerates (cretaceous?); 5. Altered sediments; 6. Granite.

The granite base of this column was observed beneath the eruptives of Mount Rainier by Mr. S. F. Emmons in September, 1870; it crops out extensively on Upper Cedar River, a stream which enters Puget Sound at Seattle; it forms the heights of the Peshastan Range, north of Ellensburg; granite cliffs of the western side of the Columbia Cañon oppose basaltic walls of the eastern bank from the mouth of the Methow River to the Wenatchie, and granite forms the mass of the Cascade Range north of the Snoqualmie Pass. In remarks recently made before the Philosophical Society of Washington, Dr. George M. Dawson described the continuation of this granite backbone northward for nine hundred miles, and he dwelt upon the absence of volcanic rocks north of the 49th parallel.

The altered sediments which rest upon the granite have yielded no fossils by which their age might be guessed, but they resemble rocks assigned to the paleozoic age by the Canadian survey, and may be of the same horizons. The beds consist of crystalline schists, limestone, and quartzite. They occur throughout the Cascade Range, from latitude 46° northward, and in the Olympic Mountains. Gold has been found in the crest east of Mount Rainier, in gravels derived from the Olympic mass, and on Ruby Creek, a tributary of the Skagit River. Magnetic iron ore occurs in the formation near Snoqualmie Pass, and hard blue specular ore occurs in association with jasper on the Skagit River. This ore and its associations very closely resemble the specular ores of Lake Superior, but they probably belong to a very different period of geologic history. Limestone and schist traversed by quartz veins form an extensive area south and west of Mount Baker, bounded on the north by coal-bearing sandstones.

The altered sediments underlie later unaltered deposits, probably unconformably; but no contact has been sufficiently well observed to determine a definite relation. A conglomerate containing agatized casts of baculites (?) was observed by an intelligent prospector on Skookum-chuck Creek, south-east of New Tacoma; another conglomerate was seen by myself in the Peshastan Range (it consisted of large granite and quartz pebbles, resting on granite, and was several hundred feet thick); and at the coal-mine on the Skagit River, sandstone dipping 40° south-west rests upon iron ore bearing schists dipping 35° south.

These three instances are the only ones known to me in which the apparent base of the recent sedimentary beds has been seen. They mark the beginning of a profound subsidence during which accumulations of sand and clay appear to have kept pace with the sinking surface. In the Wilkeson Coal-Field the thickness of these beds probably reaches 13,000± feet, with 127 coal-beds, ranging from one to forty feet in thickness. This deposit is shown by its fossils to be of fresh or brackish water origin. Unfortunately no large collections were made, and the fossils do not definitely determine the age of the coal-measures; but Prof. J. S. Newberry and Dr. C. A. White agree in considering them the probable equivalent of the Laramie.

These recent sediments occur throughout the Puget Sound basin, they rim the Olympic mass, they have been found in the high crest of the Cascades near Cowlitz Pass, and north of Natchez Pass, and they were deposited to a thickness of about 1,000 feet in the region now drained by the Upper Yakima and Wenatchie Rivers. The great thickness and wide distribution of this formation are unusual features of a fresh-water deposit, and it is difficult to conceive the conditions which maintained fresh water over the area of such a subsidence. But the problem is somewhat simplified when it is recognized that the region was an archipelago like that so recently studied in southern Oregon by Captain Dutton and Mr. Diller. The Olympic peninsula was then an island, and the continuity of the coal-measure series may well be interrupted by similar spaces not yet traced out.

This formation was checked by compression, which resulted in folds of an Appalachian type having a nearly north and south trend. The closeness of flexure varies in different areas, and the chemical concentration of the coal is proportionate to the mechanical disturbance. The extreme of uniform alteration over an area of fifty square miles was reached in the Wilkeson coking coal; but local alteration, due to later volcanic influences, frequently went much further.

This compression closed the history of sedimentary deposits in this region. It may be assumed that it took place at the same period as the elevation of the northern portion of the Cascade Range, assigned by Dr. Dawson to post-cretaceous time; but we may not yet date the uplift more definitely.

A period of erosion intervened between the uplift and the outpouring of eruptives. Mounts Hood, St. Helens, Adams, and Rainier are the conspicuous peaks of the locus of maximum volcanic activity across which the Columbia has cut its cañon. Mount Baker is the northern outlier of the line of volcanoes which begins with Shasta and Lassens Peak.

Mr. Lang's hypotheses are in part confirmed by the facts stated; but like forces have produced unlike results in California and in Washington Territory. South of latitude 42° 30′ the Cascade's volcanic mass is supported on a slightly disturbed sedimentary base: north of latitude 46° 30′ the range of closely flexed sediments is dotted with volcanic cones. The difference is one of degree, not of kind; but the difference is great.

Many of the facts condensed in this note are stated, with more detailed descriptions of the coal-measures, in a report on the coals of Washington Territory, in Vol. XV., 'Tenth Census Reports.'

BAILEY WILLIS.

Washington, D.C., March 1.

Answers.

21. GLOBULAR LIGHTNING. — The late Prof. John Fries Frazer has frequently mentioned to me having seen in his youth a ball of fire descend and strike a tree in a field in front of him. Of course, this phenomenon happened during a thunder-storm. The distance from the object struck was about fifty yards or less. P. F.

Philadelphia, Penn., March 2.

22. WASP-STINGS. — The discussion going on in your columns at the present time in regard to wasp-stings recalls a curious discovery of my boyhood. I was a very ticklish youngster, and my comrades sometimes used that weakness for their own amusement. One boy used to show me how little effect tickling had upon him; but one hot summer day, as he was lying reading, I tickled him on the ribs, and he almost went into convulsions. I found that he was far more sensitive than any boy in the company, and he revealed his secret to me under condition of my never telling any one else. By holding his breath he became pachydermatous, and would let anybody tickle him as much as they pleased; but of course they always gave it up at once when they saw his stolid look. I tried the plan, and it worked admirably; and it is my only protection, even unto this day, for my cuticle is as sensitive as ever. The deduction is simple: a man holds his breath, — and a wasp, — and the stinger is 'bluffed.' *Verb. sap.* R. MCMILLAN.

Liverpool, Eng., Feb. 21.

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SCIENCE

FRIDAY, MARCH 16, 1888.

THE MOST INTERESTING and the most valuable article in the *Popular Science Monthly* for March is one entitled 'The Antechamber of Consciousness,' by Mr. Francis Speir, jun. It embodies the result of some carefully planned investigations in psychology for the purpose of weighing anew the argument for unconscious cerebration. The mode of presentation is excellent, and shows an acquaintance with scientific method. The facts are presented by themselves without comment, and the discussion of them follows. The facts, and the writer's opinion concerning the facts, are, as they should be, kept quite distinct. The method adopted for the accumulation of data was the well-known one of distributing printed questions, to be answered from personal experience. The question in which the inquiry centred was, 'Does there exist in man the power to exert intellectual activity during unconsciousness?' The answers are grouped and summarized under four heads; (*a*) when the effort is simple, by reproducing past experiences in obedience to a mandate of the will; (*b*) by comparing related facts, and arriving at a settled judgment; (*c*) when the effort is more complex, by continuing old trains of thought begun in consciousness, and proceeding logically, step by step, to a relative settled conclusion; (*d*) when the effort is most complex, by commencing and continuing new trains of thought without having voluntarily undertaken or continued them, and arriving at results of original creation as inventions, literary and musical creations, etc. Of the first, Mr. Speir says, "Almost every individual says concerning these experiences, 'They are of such frequent occurrence that when they happen I pay no special attention to them.'" Of the second it is said that many people, during a state of perfect unconsciousness, can accurately measure time as well as, and often better than, they can in consciousness. In doing this they may perform an intellectual process similar in all respects to the conscious act of calculating a distance between known points. Of the third, "about eighty-five per cent of those answering claim to have arrived at definite results of work begun in consciousness and left unfinished, at results of a finished logical nature, at results that could come only by bridging the gap between the beginning and partial continuation in consciousness, and the perfected conclusion by predicting the existence and operation of unconscious intellectual effort as the necessary cause of the known result." Of the fourth, "only thirty per cent claim to have suddenly discovered the results of creative effort; these creations appeared suddenly, most often while the individuals were engaged in matters foreign to the discovery." All these voluminous answers could not have been collected without patient effort; and psychologists should be very grateful to the writer for laying so much that is new before them. We trust that Mr. Speir will find time and opportunity to push these investigations further, and to complete his chain of evidence by additional data.

BACTERIOLOGY IN OUR MEDICAL SCHOOLS.

IT was stated in this paper some weeks ago that inquiries were on foot the purpose of which was to obtain information concerning the attitude of our medical schools and training-schools for nurses, toward the germ-theory of disease. For this purpose a circular was sent to each medical school in the country and each training-school for nurses, requesting information on this matter. In most cases the circular was sent to the dean of such institutions, and has asked replies to the questions given below. Answers to this circular have been received from quite a large number of schools, and direct personal inquiry has elicited information from others that have not responded to the circular. In these ways information has been obtained from the following institutions and physicians: —

1. University of Colorado, J. H. Kimball.
2. Medical Department of Yale College, New Haven, Conn., M. C. White.
3. Chicago Medical College, N. S. Davis.
4. College of Physicians and Surgeons, Chicago, Ill., A. Reeves Jackson.
5. Rush Medical College, Chicago, Ill., J. Adams Allen.
6. Medical College of Indiana, J. L. Thompson.
7. Hospital College of Medicine, Louisville, Ky., W. H. Bolling.
8. Medical Department of Tulane University, New Orleans, La., S. E. Chaille.
9. College of Physicians and Surgeons, Baltimore, Md.
10. Harvard College, Cambridge, Mass.
11. University of Michigan, H. Sewell.
12. Minnesota College of Physicians and Surgeons, J. T. Moore.
13. Minnesota Hospital College, F. A. Dunsmoor.
14. C. H. Hunter, Minneapolis, Minn.
15. Kansas City Medical College, Missouri, E. W. Schauffler.
16. North-western Medical College of St. Joseph, Mo., F. A. Simmons.
17. Medical Department of Buffalo University, Buffalo, N.Y., T. F. Rochester.
18. New York Medical College for Women, C. S. Lozier.
19. Medical College of Ohio, J. T. Whittaker.
20. Jefferson Medical College, Philadelphia, Penn., Morris Longstreth.
21. University of Pennsylvania, William Osler.
22. Pulte Medical College, Cincinnati, O., J. D. Buck.
23. Hahnemann Medical College, Philadelphia, A. R. Thomas.
24. Bellevue Hospital Medical College, New York.
25. College of Physicians and Surgeons, New York.
26. Medical Department of City of New York.
27. American Medical College, St. Louis, Mo., E. Younkin.
28. Long Island College Hospital, C. Jewett.

The schools in this list will hereafter be referred to by the numbers affixed against them.

This list includes about one-fourth of the medical schools of the country; but inasmuch as it includes all of the largest schools, the proportion of students thus represented is much larger. Nearly one-half of the medical students of the country are in attendance upon the schools represented in the above list.

The answers received to some of the questions show in many cases so much similarity, that it is not necessary to give them all here in detail. The following summary will indicate the questions, and the substance of the replies: —

Question 1. Is the theory that most, if not all, infectious diseases are caused by the growth of microscopic organisms, accepted by the members of your faculty and the physicians in your vicinity?

To this question the responses have been in the affirmative in almost every instance.

Nos. 3 and 22 change the question so that it reads, "caused or accompanied by," and then answer in the affirmative. This, of course, changes completely the significance of the answer; for, if the causal connection between the microbe and the disease is denied, there is nothing left of the germ-theory.

No. 5 says, "No."

No. 7 says, "Some absolutely, some *cum grano salis*."

No. 12. "Opinions still divided, a majority of the more modern thinkers falling in with that view."

No. 27. "Not wholly."

No. 28. "No, we are not wedded to this theory. It may be true, but it may not."

Question 2. Do you regard the theory as of as much importance as is claimed for it by the various doctors and scientists who advocate it?

With the exceptions noted below, all of the replies recognize that the subject is one of great importance, this conclusion being in general based on the fact that the germ-theory emphasizes and makes possible a scientific study of preventive medicine.

The exceptions are as follows: —

No. 3. "I do not. The adoption of the mere theory as a general proposition does not add any thing to our resources for either curing or preventing disease. Every new fact that becomes clearly and definitely established concerning the existence of a microbe, a ptomaine, or any other material condition accompanying the development and progress of any disease, is of importance, because each new fact is likely to suggest such investigations as will bring to light other facts until results of importance are obtained. The popular adoption of a general theory of disease has in all ages led to an effort to make all facts conform to the theory, and thereby led to many practical errors."

No. 5. "Briefly, no."

No. 7. "No, I do not believe that the bacillus has been proved to be the occasion of disease. May it not be a product? Am open to conviction."

No. 22 says, "Further investigations very desirable. The facts are not all in yet."

Question 3. Do you think the practical value of the subject is destined to be sufficient to demand a wider and more thorough treatment in our medical schools and training-schools for nurses?

To this question a simple or an emphatic affirmative answer was given in all cases where a reply was received, except in the following instances: —

No. 3. "I think the subject receives a full share of attention in all the more important medical colleges, hospitals, and training-schools for nurses in the country. Such is certainly the case in the schools in this city, and in the medical societies also."

No. 5. "No."

No. 6. "I do not, by any means."

No. 7. "The whole subject needs to be further investigated and better understood."

No. 22. "As fast as solid ground is reached. The human mind naturally jumps at conclusions."

No. 27. "There is nothing as yet very practical about the subject: it is mainly theoretical."

Question 4. Is it practical to introduce it into a medical course as a branch of pathology?

No direct reply to this question has been received from Nos. 2, 10, 12, 19, 20, 21, 24, 25, 26. In all of these institutions, however, very special attention is paid to the study of bacteriology, as will be seen in the answers to the next question.

No. 1 says, "Yes, but the ideas advanced should be demonstrable."

No. 3. "Certainly not; and for the reason that microscopic organisms, so far as they act as causes of disease, belong to the department of etiology instead of pathology, and, if any of them are simply developed as products of disease, they belong to the department of morbid anatomy."

No. 5. "No."

No. 6. "No. It could be disposed of in a few sentences; but to make the fuss over it that some lunatics do is an abomination in the eyes of the Lord and man."

No. 7. "Not at present."

No. 8. "This is a question chiefly of finance and of public appreciation of preventive medicine."

No. 11. "I think it not only practical, but necessary to an understanding of pathology."

No. 16. "Yes, and it ought to be done, or intimately associated with it, as we have already done in our school."

No. 27. "Not as a branch of pathology settled, but it is well to treat of the subject so far as science has unfolded."

All others answer with a simple affirmative.

Question 5. To what extent does the subject receive attention in the medical course of the school with which you are connected?

The answers to this question are of so much interest, that they are given here in detail.

No. 1. "Not to any great extent, no pathological laboratory work."

No. 2. "A fully equipped laboratory for bacteriological investigation. A special lecturer is employed to give instruction. In the pathological laboratory attention is given to demonstrations of the presence of bacteria in disease. The subject of ptomaines is taught in the chemical department."

No. 3. "The subject of micro-organisms receives a full share of attention in the practical laboratories of chemistry, histology, pathology, and a well-equipped bacteriological laboratory, as well as in the teaching of every practical department, both didactic and clinical."

No. 4. "All the teachers whose branches bear upon it teach it more or less, though not systematically. We have a professorship which includes general pathology, hygiene, and bacteriology."

No. 5. "More than deserved."

No. 6. "In speaking of the causation of disease, it receives due attention."

No. 7. "Two professors of pathology."

No. 8. "All of the seven chairs enforce the germ-theory of communicable disease."

No. 9. "Special lecturer employed to give instruction on this subject."

No. 10. "Bacteriological laboratory, and a special instructor in this branch."

No. 11. "A special chair of pathology and bacteriology has recently been established, and a well-known scientific worker elected to fill it."

No. 12. "The pathology which I give in connection with theory and practice, when dealing with infectious diseases, includes bacteriology; and I am in the habit of urging the students to investigate the field for themselves, as the branch is not thoroughly developed."

No. 13. "One lecture each in surgery, medicine, obstetrics, and poisons, with four in chair of pathology, and practical microscopical work."

No. 14. "Interwoven in all the teaching. Lectures on micro-organisms, their life-histories, nature of proof that they cause diseases, etc., are given. Different specimens of bacteria are demonstrated."

No. 15. "Is lectured on and demonstrated by one lecturer on histology, who has one hour a week."

No. 16. "The subject is largely taught by the professors in surgery, theory and practice, materia medica, chemistry, gynecology, pathology, and hygiene."

No. 17. "A culture laboratory, and the professor devotes considerable time to bacteriology."

No. 18. "Professor of hygiene teaches in his lectures something of the theory of germ-cells and microbes in disease, and the importance of care and cleanliness; also the danger of eating uncooked or rarely cooked animal food. The professor of anatomy and histology also has given some very instructive discussions in his lectures on the subject."

No. 19. "A fully equipped bacteriological laboratory. The laboratory was furnished directly from Koch's laboratory in Berlin."

No. 20. "In the early lectures of the yearly course on pathology a full exhibition of the pathogenic forms is made by means of the lantern; also lectures on the relation of the micro-organisms to each disease. In the laboratory the class examine with the microscope the organisms in stained preparations of cultures and sections of tissue, etc. The method of culture-preparation, etc., are shown."

No. 21. "In the second and third years a good deal of time is spent by the students in the pathological laboratory. Bacteriology forms part of the regular course of instruction. In the department of clinical medicines the bacteriological questions in relation to diagnosis and etiology are fully discussed, and the clinical laboratory is provided with full means of research in this line."

No. 22. "Incidentally only."

No. 23. "Only in an incidental way in connection with infectious disease. I have in contemplation introducing a department for study and original experiment in bacteriology in our school."

No. 24. "A competent instructor in bacteriology, trained in Germany."

No. 25. "A well-equipped bacteriological laboratory, with a special instructor."

No. 26. "A special instructor, a pupil of Koch, gives bacteriological instruction."

No. 27. "The facts and investigations are clearly set forth, leaving the subject open to further investigation. We believe that blood-poisoning may not be due to germs. Much depends on ptomaines. Decomposition does not depend on germs. Suppuration has a cause within the body independent of germs. Germs may be the result of decomposition or animal chemical changes. At all events, we are not satisfied on these points."

No. 28. "I can speak of obstetrics only. The student is taught a rigid aseptic practice, and is daily drilled in the methods of sterilizing hand and instruments, etc."

Question 6. Do you think the general principles of the nature of infectious diseases, and the methods and meaning of infection, should be taught the general public through the public school?

The responses to this question have been quite varied, and are of course in all cases personal opinions rather than official replies. These replies are interesting as indicating various opinions on public-school teaching, and a number of them are given below; but since in some cases the request was made that the reply should not be quoted, the replies are given without reference to the source from which they are obtained.

Ten replied with a simple affirmative: others replied as follows:—

"I think that this subject, in connection with general sanitary science, might and should be introduced into the studies of the common school."

"Not yet, except in the way of and in regard to necessary disinfection, cleanliness, and general hygiene."

"Am free to say that the attempt to teach bacteriology generally would be a most misdirected effort."

"It would unquestionably be avantageous could suitable teachers be obtained; but I shudder to think of the statements which would pass current if the subject were made obligatory in even the high schools."

"Not at present, but after the subject is more fully understood."

"No, they would make a botch of it, and teach more falsehood than truth. It needs more acquaintance with the subject than can be expected of non-medical or non-expert teachers."

"Yes. If physiology and healthy function are taught, of much more importance would it be to sow the seed of understanding how to keep those functions healthy in all ways. An elementary work on preventive medicine, including bacteriology, should be taught the young. It should be so prepared that the mind could grasp it without being prepared by a medical education."

"To some extent it should; but so very much is crowded into the children's heads, that they become dazed, and are mere parrots when they get through."

"No, certainly not: first, because not one per cent of the scholars in the public schools have reached the stage of maturity and mental discipline necessary to enable them to comprehend or profit by the teaching of such subjects; second, because the public schools are already over-crowded with so many branches of higher and more abstruse character, that not twenty-five per cent of the scholars are allowed time enough to gain an adequate knowledge of the most rudimentary and practical branches of knowledge. Consequently it is much easier to find boys and girls who can repeat Latin, French, or German, finger a piano, recite verbatim answers from a manual of physiology, etc., than to find those who can write a letter containing one or two hundred words without violating some of the most important rules of orthography, syntax, and penmanship."

"I do not think any one connected with this school would advise the introduction of bacteriology in our public schools."

"First teach the profession, and through them the public. No objection, of course, to extending knowledge in every possible way, but don't think it yet time to expect much through public schools. We must first show more facts."

"No harm, little good."

From the circulars sent to the training-schools for nurses, no responses have been received. This is the more to be regretted, since, if preventive medicine is of value to any one, it is to nurses.

A few words in final summary and review may not be amiss. The question naturally arises, whether the responses from the schools above given can fairly be taken as an average, and whether we can judge of the whole body of medical schools by the replies received from those in the above list. I think it cannot be assumed that this is possible. The above list includes nearly all of the larger schools, and those in which most advanced methods would be expected. It seems quite natural, also, that those institutions which have given any considerable attention to this subject would be more likely to respond to the circular sent by *Science* than those which had not yet regarded the subject as of sufficient importance for careful study. It is almost certain, therefore, that, if responses should be received from the remainder of the medical schools, there would be found a much larger proportion in which the subject is considered only incidentally or not at all, a much larger proportion in which the germ-disease theory is regarded as of little or no importance.

The fact that no responses have been received from the training-schools for nurses can hardly be interpreted as having other significance than that the subject of bacteriology has not received enough attention in these schools to warrant any opinion on the matter.

From the replies above summarized, even though they are less general than could be wished, I think we can fairly draw the following conclusions: —

1. The germ-theory has in the past few years been rapidly acquiring acceptance, is almost everywhere regarded as a subject worthy of most careful consideration, and is nowhere looked upon as an absurd speculation, as was the case a few years ago. The causal connection between specific microbes and definite diseases is not yet, however, everywhere acknowledged by physicians.

2. Quite a number of special bacteriological laboratories have been established in connection with our larger medical schools. They are under the charge of competent directors, and are places where original research is being carried on, and where students have an opportunity to familiarize themselves with the subject in a practical manner. American medical schools are thus doing their share in this research in this matter, and in the endeavor to advance our knowledge of bacteria and their relations to disease.

3. A large number of our schools, probably a large majority of them, do pay considerable attention to bringing to the notice of their students this subject in its theoretical and practical bearings. In some cases it is only done incidentally, in others by a few odd lectures, and in others by regular courses of lectures and laboratory instruction. As much is being done in this line as can be expected, when we remember that not a few of the medical courses are, of necessity, little more than periods of cramming to give the students just enough knowledge to enable them to make ordinary practitioners. The course is frequently so short as to make it hardly a possibility to treat scientifically any subject not directly bearing upon the treatment of disease. It will be noticed that the amount of attention given to the subject is not regulated by the amount of importance placed upon it by those who have answered the circulars. In some cases where the theory is rejected it is still taught in the school; and in others, where it is fully accepted and regarded as of great importance, the amount of teaching is yet very slight. This indicates that it is usually difficulties of finance or otherwise which in many cases have delayed the adequate consideration of the matter.

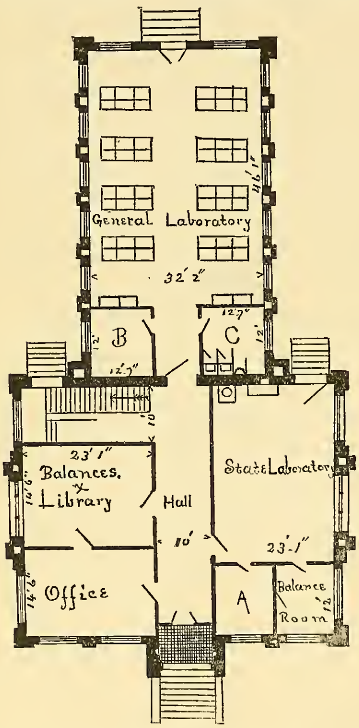
4. It would be the opinion of probably a majority of physicians and teachers, both of those who believe in the importance of the subject and of those who do not regard it as of much import, that the time has not yet come when bacteriology can be taught to advantage in the public schools: at least, this cannot be done until some thoroughly competent person shall have carefully summarized the facts in the form of a short, clear account, which could be used as a text-book. It must be borne in mind, however, that many physicians are, for reasons similar to those given above, opposed to the teaching of physiology in the public schools. This is, however,

generally recognized as advantageous, and in some States required by law. It certainly seems, that, if physiology is to be taught, there would be just as few evils, and much more of value, accruing from the study of the principles of infection and subjects connected therewith, than results from the study of many subjects now taught under the head of physiology. The value of the study of bacteriology in the colleges and universities is more evident, and has been well shown in the letter of Mr. Theobald Smith, published in a recent number of this paper.

In conclusion, then, it may be said that our medical schools and profession generally have been and are advancing along this line of bacteriology as fast as can be expected. All of the larger schools have taken up the subject in a thorough manner, and many of the smaller ones are doing the same. The indications are, that a few years will see bacteriology established as a subject to be taught, either as a branch of pathology or otherwise, in all of the medical schools whose financial condition will warrant it. H. W. Conn.

CHEMICAL LABORATORY OF THE ALABAMA POLYTECHNIC INSTITUTE.

We present in this number of *Science* a cut of the new chemical laboratory of the Agricultural and Mechanical College of Alabama, located at Auburn. The substantial growth of this institution has been such that the trustees, at their annual meeting in June of last year, authorized the construction of a new laboratory in connection with the Agricultural Experiment Station and the State Department of Agriculture, of which the professor of chemistry is the official chemist, and for original research. At a subsequent meeting in July, it was determined to erect a larger building than at first contemplated, and transfer to it the chemical department of the college.

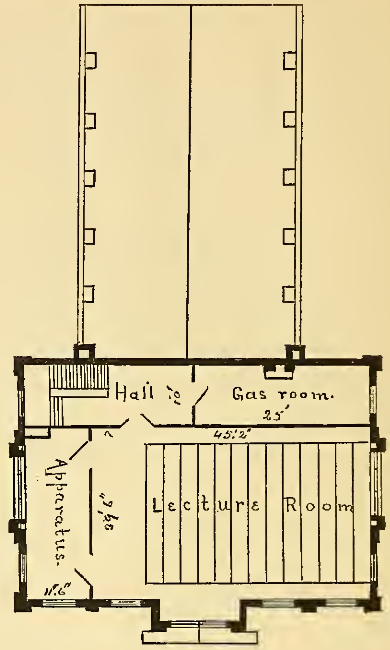


FIRST FLOOR.

A, Spectroscope and polariscope room ; *B*, Assistant's private working-room ; *C*, Combustion-furnace room.

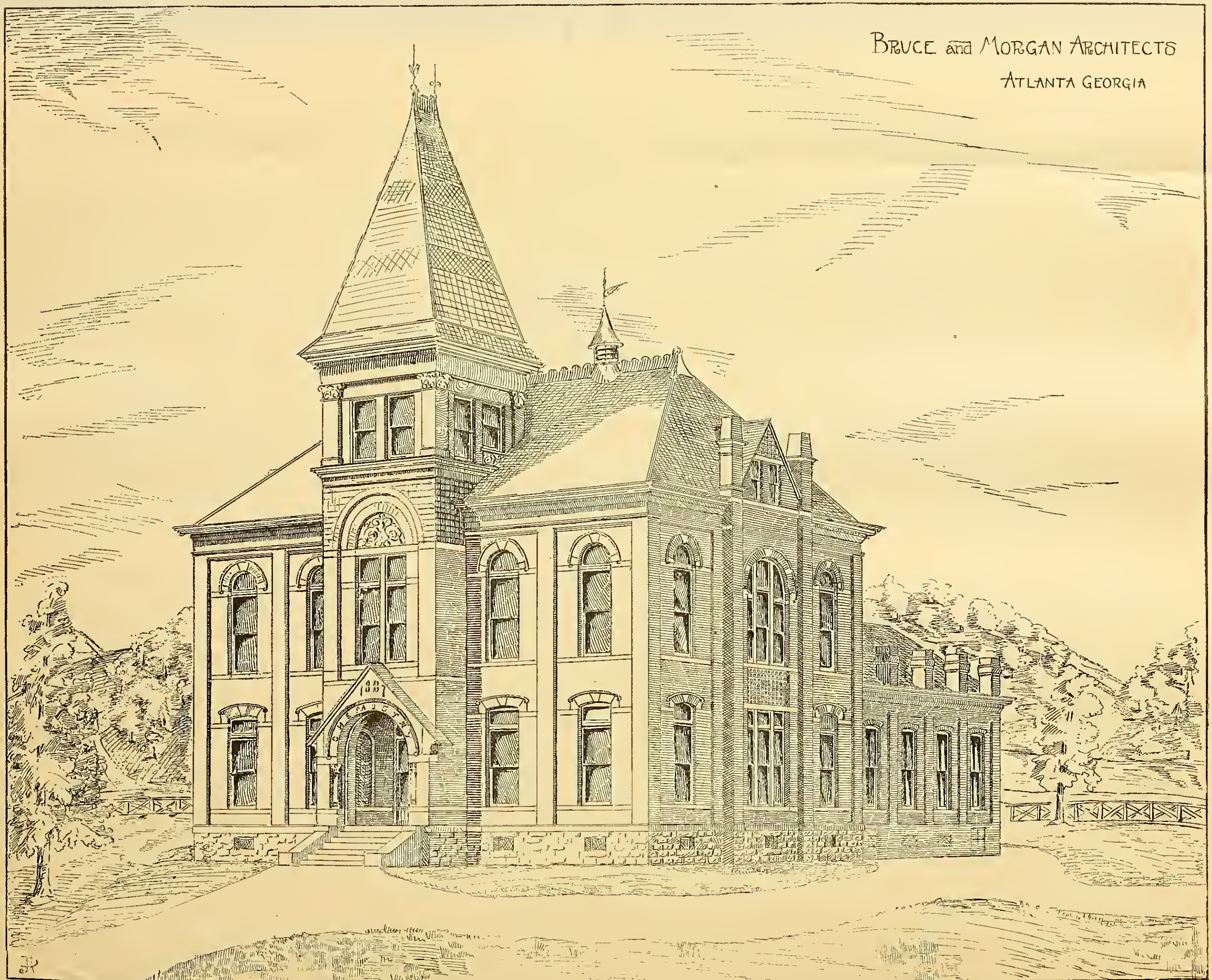
The building is a handsome two-story structure, 40 by 60 feet, with a stately tower, and a rear projection 35 by 60 feet of one story, and basement. The exterior is of the best quality of pressed brick, laid in red mortar, with cut stone trimmings and terra-cotta ornamentation.

The main floor contains a central hall ten feet wide, with side hall for stairway of the same width, but extending only halfway across the building. On entering through the large archway under the tower, the first room to the left is the office of the professor of chemistry, to the rear of which is the library and balance-room. On the right, extending the whole length of the floor, is the State laboratory and laboratory for research. Two small rooms are cut off from this, one to be used as a balance-room, and the other for the spectroscope and polariscope. Leading from the rear of the main hall is the door which enters the large laboratory for general work. Two rooms are cut off from this, — one for combustion furnaces ; and the other, a private working-room for the assistant.



SECOND FLOOR.

In the basement are ample accommodations for assaying and storage. The main laboratory will accommodate sixty students, and, when the fitting-up is completed, will contain the latest improved working-tables, with water, gas, and every necessary appliance for chemical work. Niches in the walls opposite each working-table, with hoods where necessary, connect with flues, and furnish the best possible means of escape for deleterious vapors, while ventilators in the ceiling furnish additional means for getting rid of noxious gases. The pitch is sixteen feet in the clear, with panelled ceiling of oiled Southern pine. The rooms are wainscoted throughout, and finished in natural wood. The second story contains a large lecture-room and room for gas-analysis. Around this lecture-room, suitably arranged, will be cases for containing crude and manufactured products, illustrating the subjects of agricultural and industrial chemistry, which are prominent subjects taught in this institution. Since the war, the South has awakened to an appreciation of her vast industrial resources, and every effort is made to educate her young men in a way that will prepare them to utilize her vast deposits of coal and iron and marble, and other valuable minerals, as well as to maintain, and if possible to increase, the productive capacity of her soil.



STATE CHEMICAL LABORATORY — AUBURN ALA.

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ONE YEAR OF INTERSTATE COMMERCE CONTROL.—WHO IS THE GAINER?

JUST one year ago the government laid the iron hand of a Bismarck upon the railways of this nation, their procedure, tariffs, and particulars, under guise and pretext of a provision of the Constitution, framed at a time when railways were unconceived of in the brain of man, and when the only possible object of that provision must have been to prevent internecine commercial hostilities or discriminations among the States. Who has been benefited? The best evidence attainable ought to be the statement of the commission appointed to administer the statute taking control of the railways. In this first annual report the commission says (the Italics are ours), " The Act to regulate commerce has now been in operation nearly eight months. . . . It has operated directly to increase railroad earnings, especially in the cutting-off of free passes on interstate passenger traffic. . . . Freight traffic has been exceptionally large in volume, . . . *no destructive rate wars have occurred*, but increased stability in rates has tended in the direction of stability in general business." In other words, then, it is the railway companies which have been benefited.

But this was not the object of the statute. The railways had not complained of ill treatment. They had, indeed, recognized the immense complications of competing systems, the damage suffered by the people from the rate wars and unjust recoupments for the expenses thereof, and had themselves provided a remedy by the establishment of so-called 'pools;' which, however, the Act of Interstate Commerce promptly and peremptorily abolished. It is something of a commentary on the words we have put in Italics above, that whereas, at the date at which the statute took effect, the situation was tranquil and satisfactory (the 'pools' having lowered rates to a minimum never reached before), the passage of the Act sent tariffs upward at a bound; and before the report above quoted had left the binder's hands, a rate war began in the West whose bitterness has, so far, surpassed in violence any ever known. At this writing the companies engaged have lost, and are daily losing, millions, until several of the roads involved have ceased to solicit freights, because to do no business is cheaper than to move their trains for unprofitable transportation. And it will not fail to add comment to commentary, that while this very Interstate Commission has been sitting calmly at Washington, dismissing trivial complaints against great trunk-railway systems, the ironclad statute which creates it forbids these very warring railways from warding off bankruptcy by coming together, pooling their issues, and terminating the battle which is sapping their resources. Next July the semi-annual dividends will be found adjusted to this rate war, and so the people of the United States will pay all the bills; and the railways, relieved of their burdens, can go on again. But such relief will clearly only be temporary as to them, with the prospect of more wars and more bills for the people to pay. Meanwhile the statute of interstate commerce continues to centralize without adjusting, or attempting to adjust, the larger problems, while carefully hearing and writing opinions as to the least of minor and local particulars of which individuals believe themselves warranted to complain; and this, although the statute itself expressly empowers the commission to take jurisdiction of its own motion, and in the absence of any actual complaint whatever (on grounds of public policy, no doubt; but, upon whatever policy, an opportunity just now very carefully overlooked by this honorable commission).

By the time this paper appears in print, the warring railroad companies will probably have come together in 'conference,' 'committee,' or 'synod,' and terminated the ruinous battle I have above alluded to. Only (in deference to the statutes of united Germany, and the Bismarck policy whose spirit has materialized among us in the shape of an interstate commerce law), whatever they call it, they will be mighty careful not to call it a 'pool.'

But why should the interstate commerce statute be operated to favor the railroads? Such were not the reforms sought. The Interstate Commerce Act was the concentration of popular forces, which had for years fought railway incorporations in our legislatures and in our courts: the crystallized expression of fifty years of popular discontent with railway management throughout this Republic. The people looked to the first utterance of a commission created to administer it, for arraignment of the wrecked railways for their disregard of popular rights, their high-handed indifference to law, and their supercilious contempt for the non-railway element in the community, that should be scathing in its terms, and triumphant in its justification of the government's constitutional right to assume control of a private interest, and to take the first step toward that centralization which Washington deprecated in prospect, which Jackson scotched in its birth, and from the possibility of which a bloody and costly civil war was supposed to have finally relieved. Nor was it mere aimless legislation. The experiment of biennial or even triennial legislatures in some of the States, as tending to decrease the volume of legislation, has always been found to work well. The volumes of session laws of our States are, as to their bulk, apt to become mostly lumber in a surprisingly short time, the number of statutes whose usefulness will survive the first few years of their passage being found a surprisingly small one. And even of our National Legislature it can be fairly said that the more time it wastes, the greater the nation's gain. But the interstate commerce law was no product of mere zeal, or temptation to legislate on general principles. It was the offshoot of sentimental prejudice and jealousy, no doubt; but its fathers and advocates in Congress cannot be suspected of having been actuated by either motive. The vastness of the nation's growth for half a century had rapidly made railroads into systems. The immensity of the plants, the accumulation of costly rolling stock, the huge volume of business, could not fail to impress the people with a sense of power not proceeding, like the power of the government, from the consent of the governed — from themselves. The enormous operations carried on daily in the people's eyes suggested enormous profits, and engendered popular discontent. These enormous operations necessitated new channels and feeders; that is to say, new railways. To save time, the ingenuity of the nineteenth century had devised construction companies, which, by subscribing for the capital of these new roads, should obviate the slow and tortuous collection of money by private solicitation; and these, centralizing profits as well as subscriptions, massed wealth in localities, and attracted the popular envy. The boundlessness of all these brought great bankruptcies for courts to deal with; and the result of each was the inevitable wrecking of great corporations, and the private accumulation of wealth in the hands of the winners in these legal fights. No sooner was this the situation than a new problem intruded itself upon the already complicated maelstrom. The movement known in Europe indifferently as internationalism, socialism, or nihilism (where it grew originally from the discontent of the constantly enlightening and self-educating masses at the support in opulent idleness of privileged classes, useless courts, and — to the people — always absolute monarchies) was utilized to express among us the popular envy, discontent, and prejudice against corporations it felt in Europe only against kings; and the result was felt in strikes, trade-combinations, and central labor unions, where one trade supported another, and each all, in abandoning work by the thousands and ten thousands at one and the same time. Underlying all this was, of course, the capital fact that the railway industry itself was not at fault; was not responsible for the shrewdness of the Wall Street operator: for intentional defaults in dividends and interest procured for wrecking purposes: for the huge competition and the closeness of margins which put them at the mercy of a single disastrous season. The president of a great railway recently asserted, in answer to a demand from the company's employees for higher wages, that in twelve years his company had not only not netted a dollar, but had actually mined and distributed 51,000,000 tons of coal at a cost of $51,000,000, and paid $53,000,000 for the privilege! The margin of profit had disappeared entirely in the giant competition of American railway companies, which yet had given, and was daily giving, support to almost a tenth part of the people of the United States.

But great economic facts like these, like great investments, lose strength by their very immensity. The laborer working ten hours a day, six days in the week, with a family of ten children clamoring for food, cannot be approached with figures showing, that, out of a hundred millions of income, his employer had not been able to reserve one ten-thousandth per cent; that the private fortune amassed by one man in railway wrecking was the crystallization of ruinous losses to thousands of smaller capitalists not of the working-men; that the plant of the great corporations had been paid for by the hard-earned savings and small economies of thousands more; and, most of all, that, of the total of all these losses and savings, almost a hundred per cent had gone to pay for labor, and for material the cost of which itself was largely the labor of handling it. Such statements as these, few of his betters have the brains to grapple with. The day-laborer may have sundry vague impressions that he should be paid in proportion to the number of his children rather than according to the value of his services; that the idea of anybody handling a million of money is a personal affront; and that altogether he is a slave, and that any change and convulsion, and shifting of bases, could not make him more wretched, and brought an even chance of betterment. He may not even be equal to these ideas, but simply absorb the single idea that the master of his local union has money to occasionally pay him a *per diem* almost as great for not working as he receives from his employer for working. But he knows that he is the slave of somebody. The nearest railway company is to him the most prominent representation of massed wealth, and he accordingly selects it for the slave-driver against whom he is to rebel. Everybody saw the wrong, but the remedy was not so apparent. Everybody sees logically that the railway as an institution is innocent of all this chaos. But logic is one thing, and practical solution, quelling of clamor, amelioration of disasters, are quite another. So it was that when the complicated problem reached the floor of Congress, it was no longer a sentiment, a prejudice, or a jealousy: it was a mighty and imperious fact, demanding and insisting upon immediate attention. Congress passed the Act to regulate interstate commerce, the President approved it, and it was the law of the land. It has been in operation a year. So far as the people of these United States are concerned, has it changed the situation (existing at its approval, and admittedly clamoring for remedy) in the slightest degree? Have strikes ceased? Are rates lower? Have private fortunes disappeared or ceased to be accumulated? Have the railways been curtailed in their despotic sway over the lives, fortunes, and liberties of our people? Had any recipient of a pass over one of our railways, or of a drawback, rebate, or special privilege, complained to Congress that he had been so favored? (That concessions to the few were injuries to the many, and the 'pass' system an unmitigated wrong and nuisance, — these were the complaints of the railway companies, not of the people; and Congress had heard them with ears as deaf as adders' ears for the last quarter of a century.) To these questions some of us are still looking for an answer, others the commission itself has answered for us. The Interstate Commerce Commission (to its credit everlastingly, be it said) did not wait for the filing of its first annual report to come boldly forward and tell the people of the United States that they were in error; that the railways were not their enemies; that, although bound to assume that it had been created for some wise purpose, and therefore to hunt around to find that purpose, the commission did not propose to share in the communistic cry of 'Down with the railways!' or even to admit that railways were a menace to the liberties of the people. It seized upon its first opportunity to assume that the statute of interstate commerce was of no practical value to anybody, but intended to be understood in a purely Pickwickian sense.

That opportunity was the presentation of a petition, on the part of one of the corporations to be brought under the paternal power of the commission, — the Louisville and Nashville Railroad Company, — for relief from the operation of so much of the fourth section of the Act as prohibited railway companies from charging more for the 'short haul' than the 'long haul,' — a prohibition which was and is the gist of the Interstate Commerce Act, and which opens up the entire question of the right of a railway company to judge for itself as to its right to live, operate its roadway, to pay its fixed charges, or generally to conduct the business for which the people had incorporated it. For to say that a grocer may sell sugar, but that if another grocer across the way also sell sugar the first grocer may not compete with the second grocer, is clearly to so embargo the first grocer as to close him out. To be sure, the law added a clause limiting the prohibition to "substantially similar circumstances and conditions;" but the limitation scarcely helped matters, since it merely substituted a question of fact for a question of law, and opened an interminable and costly field for the taking of testimony and the examination of witnesses which could easily paralyze any interest forced to enter it. Besides, to recur to the simile of the grocer, it might be said to permit the retail trade in sugar only on condition that no wholesaling was attempted. He might sell a pound of sugar at any price he could get, but must be careful, if he sold a thousand hogsheads, not to diminish his rate per pound, either by quoting his commodity at less, or by rebating or offsetting for the comparative magnitude of the transaction. Such, then, being the opportunity, the cause of the client, the opinion of the commission in this first case of importance was looked for as an emphatic justification of the law the people had enacted.

But on being promulgated, the opinion, so far as any crimination of the railway companies or any indication of the constitutionality or policy of the law was concerned, turned out to be as unsatisfactory to the non-railway public as Balaam's cursing of Israel was to Balak. "What hast thou done unto me?" cried the disappointed king. "I took thee to curse mine enemies, and, behold, thou hast blessed them altogether." The first pronouncement of the Interstate Commerce Commission begins with an apology for not interfering with the railway companies, which, to say the least, was unique in juridicial literature. It declared (p. 5[1]), that, "if the commission were to perform the inquisitorial duties imposed upon it, it would be compelled to forego the performance of judicial and other functions which by the statute were apparently assumed to be of high importance, and even then its authority to grant relief would be performed under such circumstances of embarrassment and delay that it must in a large measure fail to accomplish the beneficial purposes which it must suppose the statute had in view." The commission deprecated any performance under its inquisitorial function, since that function "in a single case might require for its proper determination the taking of evidence all the way from the Pacific to the Atlantic; and this not merely the evidence of witnesses for the petitioning carrier, but of such other parties as might conceive that their interests or the interest of the public would be subserved either by granting the relief applied for, or denying it" (p. 5). Certainly, nobody can blame the commission for preferring to sit cosily in Washington and exercise judicial functions than to take testimony not only of the parties before the commission, but of any party who might consider himself aggrieved by any act of a railway company or by any proximate or remote effect of such act or its theory, from Maine to California. And, even should the commission be able to decide the matter before it without the bother of hearing testimony, the commission admits that "an adjudication upon a petition for relief would in many cases be far from concluding the labors of the commission in respect to the equities involved: for questions of rates assume new forms, and may require to be met differently from day to day: and in those sections of the country in which the reasons or supposed reasons for exceptional rates are most prevalent, the commission would, in effect, be required to act as rate-makers for all the roads, and compelled to adjust the tariffs so as to meet the exigencies of business while at the same time endeavoring to protect relative rights and equities of rival carriers and rival localities." "This [and here is a touch of nature which shows, at any rate, that an interstate commissioner's life threatened at the very outset to be no bed of roses] in any considerable state would be an enormous task. In a country so large as ours, and with so vast a mileage, it would be superhuman. A construction of the statute which should require its performance would render the due administration of the law altogether impracticable" (p. 5) says the commission finally. And yet, if the Interstate Commerce Act means any thing, it means just what the commissioners, in their first decision, declared to be impracticable, — superhuman and impracticable! Here are seven commissioners, at a salary of seven thousand five hundred dollars per annum, launched with an appropriation of one hundred thousand dollars from the people's treasury, and on that equipment expected to supervise the hourly business of a continent at present in the hands of perhaps a couple of thousand auditors, with a combined staff of a hundred thousand clerks and agents — with salaries ranging from twenty thousand dollars downwards, and overworked at that! But to proceed with examination of the opinion. Having frankly admitted that to endeavor to discharge the functions it was organ-

[1] The references are to the official copy of the opinion printed at the Government Printing-Office, Washington, 1887.

ized to administer would be superhuman and an impossible task, the commission sets to work, as in duty bound, to find something to do. It is legally bound to assume that it was created for a possible purpose, to do something not superhuman. And so the commission, groping, as it frankly admits, in the dark, strikes at last upon the cause, "under substantially similar circumstances and conditions," and finds at last a foothold. Surely, it says, "if the carrier . . . shall depart from the general rule, . . . if the circumstances and conditions of the two hauls are dissimilar, the statute is not violated." Clearly, if Congress shall take the grocery trade under its jurisdiction, and declare that the poor man must not be obliged to pay more per pound for his two pounds of sugar than the dealer pays per pound for his two thousand hogsheads, it would put an end to the wholesale grocery business on the instant. But if Congress says that this rule shall only apply to the sugar made "under substantially similar circumstances and conditions," then the sugar trade may go on in peace, as before, relying on the immutable truth that no like transactions are or can be under the same circumstances and conditions, and foregoing to attempt the 'superhuman task' of taking evidence all over the continent, — from the planters, the cultivators, the harvesters of the sugar-crop, the teamsters who carried it to the railroad, the shipper, the booking clerk, the carrying company, and so forth and so on, down through the jobber, the wholesaler, to the consumer or the messenger sent to pay the twenty or twenty-five cents for the brown paper parcel, — in perfect faith that in no two cases can the adjective clause 'substantially similar' be predicated to any one transaction when collated with any other transaction on record. Certainly the commission is right. Indeed, the wonderful part of the opinion is in the exact legal consistency and candor with which it admits that the law is one, *which, if logical, is impossible of enforcement: and, if illogical, can only be administered by leaving matters precisely as they were before the law was passed!* Following the above line of reasoning, the commission declares (p. 6) that the statute becomes practical, and may be enforced without serious embarrassment. The commission, having settled this much, now proceeds to collate the two sections of the Act which relate to the long and short haul (Sections 2 and 4), and proceeds, "It is not at all likely that Congress would deliberately in the same act, and when dealing with the same general subject, make use of a phrase which was not only carefully chosen and peculiar, but also controlling, in such different senses that its effect as used in one place upon the conduct of the parties who were to be regulated and controlled by it would be essentially different from what it was as used in another" (p. 7). And therefore the commission renders its decision in a sentence which I must be pardoned for putting in Italics: "*Beyond question, the carrier must judge for itself what are the substantially similar circumstances and conditions . . . on peril of the consequences*" (p. 7). But is not this what every carrier (nay, every business-man) does, has always done, and always will do to the end of time? And is not this a pronouncement from the mouth of the Interstate Commission itself, that if the clause 'under substantially similar circumstances and conditions' is of the essence of the Act, then the law is a nullity?

But after having arrived, by application of every rule of law, and the legal construction of statutes, — that is to say, by irresistible logic, — to its conclusion on p. 7, the commission proceeds for twenty-two pages more to discuss analytically and still logically the situation. What situation? The case submitted by the petition, the Louisville and Nashville Railway Company, was simply the case which arises every moment of the day to any railroad company which carries freight for hire; and while considerable percentage of these cases are not necessarily 'interstate' in their character, yet every practical railroad man (certainly every student of political economy) knows that such a character, from a commercial standpoint, could be given to almost every one of them without any difficulty. The remaining twenty-two pages of this startling opinion — startling in that it is a confession at the outset that the Interstate Commerce Act cannot change the situation without discontinuing the business and commercial transactions of the people of the United States — is merely an analytical examination of the reciprocal relations which arise between a shipper and a carrier in any contract of transportation.

The commission proceeds to lay down the following propositions, which it deduces from the case before it, and the evidence taken: —

"1st, That the support and maintenance of a railroad ought properly to be borne by the local traffic for which it is supposed to be built, and the through traffic may justly be carried for any sum not below the cost of its own transportation.

"2d, That the cost of local traffic is greatest, and the charges for carrying it should be in proportion; and, if they are so, they will often result in the greater charge for the shorter haul.

"3d, That traffic carried long distances will much of it become impossible if charged rates corresponding to those which may properly be imposed on local traffic; and it must therefore be taken in recognition of the principle accepted the world over, that the traffic must be charged only what it will bear.

"4th, That the long hauls at low rates tend to build up manufactures and other industries without injury to the traffic upon which rates are heaviest.

"5th, That charges on long hauls which are less than the charges on shorter hauls over the same line, in the same direction, are commonly charges which the carriers do not voluntarily fix, but which are forced upon them by a competition from whose compulsion there is practically no escape."

Since the above propositions are axioms in railway management, and since, however immutable, axiomatic, and eternal they are — were before there was any Interstate Commerce Act or Interstate Commerce Commission, and will be after both have been numbered among the figments of the past; since the commission is not supposed to be organized for the purpose of ruling that black is black, and white is white, — what was left for the commission to say to the railroads of the United States except, "Depart in peace, be ye warmed and filled, you have done nothing worthy of death or of bonds, you have conserved the best interests of the people, have built up a continent, and are worthy of the highest praise"? That is precisely what it does say, for it unhesitatingly adds, "On the construction we give to the statute, these several applications need not have been filed, and therefore they might now be withdrawn without further judgment" (p. 8). But the commission remembered the Act upon which it was created, and that it was expected to justify at least the action of Congress in creating it, and so announced its willingness to go into the merits of the question (it had just decided that there was no question), making its excuse, "that it is manifestly important to the public interest, as well as to that of the railways themselves, that mistakes shall be as far as possible avoided" (p. 9), — (a proposition to which certainly nobody can demur); or to limit these propositions, or discover anywhere a public need or benefit that the management of the railways of the country have overlooked. How should the situation be changed to benefit the people? How can it be changed without destroying our interstate commerce; nay, without destroying the welfare of the country and paralyzing all business transactions? "Every railroad company," says the commission, "ought, when it is practicable, so to arrange its tariffs that the burden upon freights shall be proportionate on all portions of its lines, with a view to revenue sufficient to meet all the items of current expense, including the cost of keeping up the road, buildings, and equipment, and of returning a fair profit to owners." But this is precisely what every railroad does, has always done, and always will do. To attempt to make tariffs other than proportionate would require an increasing of its book-keeping expenses, and of its auditing bureaus, to every railroad company, which would make it cheaper to go out of the business than to continue. In other words (the words of the opinion), "a railroad ought not to neglect any traffic of a kind that will increase its receipts more than its expenses" (p. 22). To state it frankly, therefore, the opinion of the commission, in the case of the Louisville and Nashville Railroad Company, is a benign approval of the business methods of our railroad companies which certainly merits the exclamation of King Barak over the efforts of the prophet Balaam.

And then the commission repeats in detail its already general commendation of the railways of this Republic. It says that they may compete with Canadian railways (p. 22) and with the watercourses (p. 22). And the commission therefore arrives at its rulings

(p. 27), which (except that it interprets the short and long haul clause to mean that a question of fact is thereby substituted for a question of law; and, inferentially, that to determine it the testimony of every individual in the employment of the railway must be taken by the court) *does not in the slightest degree* change the habitude and method of running a railway; does not introduce a single innovation, or modify a single rule of railway operation: in other words, Congress has enacted a statute which a commission chartered to enforce it declares *enacts that things shall remain as they are*, and that, if the statute is ever suspected of interfering with things as they are already, the subjects of the statute must interpret it blindly and at their own peril!

It would seem, therefore, that the commission itself has decided that the railways of this Republic have been, up to the date of its own appointment, properly managed: certainly there is no disapproval of any particular acts, and only in the sixth ruling does it condemn certain possible acts and differentiations which it is not alleged that any railways have been guilty of, and which certainly, therefore, is mere *obita*, or the expression of a general opinion upon a very interesting but entirely gratuitous conundrum of suppositious railway policy. But is not a disturbance of constitutional limitations a rather high price to pay, even for so valuable a boon as is a governmental approval of American railway management? Once broken, who can say what will pass these barriers? Perhaps there may yet be established at Washington an interstate theatrical commission which shall review and absorb the early functions of Master of the Revels, stage censor, and Lord Chamberlain! And, indeed, for such a bill, congress need not again borrow its policy from an Empire of Blood and Iron. It can get its suggestion this time from a Republic — from Mexico — where theatres are not only under the espionage of government, but even the migratory Yankee circus is officially coerced into living up to its posters.

APPLETON MORGAN.

MENTAL SCIENCE.

Morbid States of the Attention.[1]

THE absence of attention is usually termed 'distraction,' but there are really two kinds of lack of attention. In the first there is a constant flitting of the mind from one idea to another, a constant dissipation of the energies in all directions, for which the word 'distraction' may be retained; and there is the lack of attention to the impressions going on about us, due to the fact that the attention is really absorbed in something else, — this is absent-mindedness, which is thus an extreme 'present-mindedness' to a different train of thought, and may be termed 'abstraction.' It is with the exaggeration of one or other of these two conditions that morbid states of the attention are allied. If we take as a convenient definition of normal attention, 'a *temporary* predominance of a mental state with a natural or artificial adaptation of the subject,' then we can distinguish two groups of morbid deviations: (1) an *absolute* predominance of such a state that becomes fixed and cannot be dislodged from consciousness; and (2) a state in which no idea can get an audience, and the attention is too weak to hold an impression steadily in the mind. To this may be added a third group, in which, through congenital defect, the power of attention never develops, as in idiots and the weak-minded.

There are all degrees of transition, from a normal concentration of the attention to the most imperative forms of fixed ideas. We have all been haunted by an aria which we cannot stop humming; have been anxious about a sick friend, so that in spite of ourselves we could think of nothing else. This is a mild form of possession by an idea, that is more persistent than any other, keeps itself in consciousness, and by imperceptible steps passes beyond the control of the will. The profound absorptions of many great men in their work are so much beyond their own control that one cannot but recognize an element of the morbid in them. When the object of reflection is a less worthy one, and the devotion to it, far from coinciding with the intentions of the individual, seems to him as an imposed task, we speak of an insistent idea (*zwangsvorstellung* of the Germans). M. Ribot distinguishes three kinds of such, according as the purely intellectual, the emotional (usually a fear, as the long list of phobias indicates), or the voluntary (usually a morbid impulse to an absurd or criminal act, kleptomania, etc.) predominates. The first class is the most important in this connection. The insistent idea takes many shapes, and in most of these we can trace analogies to our own every-day experiences. There is an arithmetical form of it, that sets the patient to ask, Why are men just so and so high? Why have houses this particular height? and so on. Again: it may be a mania for counting every thing, — the number of pavements on a street, the number of streets in a city. The sight of a bag of grain irresistibly led one patient to estimate how many grains there are in the bag, how many in the country, etc. Another must count all the trains leaving the railroad-station, and keep account of their destinations. In these cases the patients often recognize the morbid nature of their thoughts: they fight against them, know that they are wasting time; but the ideas fill their minds completely, and demand attention with a tyrant's power. A feeling of intense discomfort, of an impending evil if they fail to count the trains, etc., is sometimes associated with the state. There is, too, a metaphysical mania, in which the mind busies itself with unanswerable questions as to the constitution of matter, the final ends of nature, and so on. Persons thus affected are usually of more than average culture; for the concentration of attention implies mental power. Nor are the objects of their thoughts entirely different from ours: the main difference is in the time and the control of these states. We think of such problems for a while, and then pass on to something else: to them that is impossible. In other respects such patients are often perfectly sound, and show great ingenuity in concealing a knowledge of their weakness from their associates. In general, it can be said that a large proportion of persons thus afflicted are the offspring of neuropathic parents, and not infrequently show other and physical symptoms of a degenerate stock. But the environment, education, must be called into account to explain others of them; and each case, especially as regards the particular form that the idea takes, must be studied by itself. The state differs from the normal, then, in degree rather than in kind. It is persistent, it is intense, it allows no relapse to a diffuse condition of the attention, and, as a mark of nervous disorder, it carries with it a weakness of the will that cannot drive out the unwelcome and officious visitor.

A more intense and acute concentration of the attention is to be found in the trance state, or ecstasy. This is allied to contemplation, to absorption in intellectual work, and brings with it an insensibility to outward impressions. When the state is very profound, such impressions can be intense and yet pass unnoticed. Archimedes, during the taking of Syracuse, remains absorbed in his contemplations. Soldiers often do not know they are wounded until the fight is over. Here, again, there is a high degree of mental power necessary, though it is often exhibited by fanatics otherwise mentally inert. But M. Ribot properly distinguishes between the cases in which the object of the contemplation is a sensory one and those in which it is purely ideal, and adds that the fanatics usually display the former kind of extreme attention. As a type of the more spiritual kind of ecstasy, the remarkable confessions of St. Theresa (a Spanish religionist of the sixteenth century) is cited. She describes no less than seven stages of ecstasy which are in a rough way capable of a psychological interpretation. The first is a state of 'vocal prayer;' that is, the praying in a loud voice draws the attention away from the outside world. The second stage is termed 'mental prayer.' The sensory impressions are no longer necessary, the mind being held by the ideas that fill it. The 'prayer of meditation' marks the third stage, which is perhaps only a more intense form of the previous state. The fourth degree is characterized by the 'prayer of passivity.' Here the soul no longer produces, but receives, has truth directly impressed upon it without the need of a logical demonstration. The fifth stage, the 'prayer of union,' marks the beginning of the ecstasy, but it is as yet an unstable state, and the possession is not profound. Finally, in the sixth stage, the 'prayer of rapture,' the body becomes cold, speech and respiration are checked, the eyes are closed, the slightest movements require great effort, and in rare cases consciousness is lost. The seventh degree of ecstasy is very mystically described.

[1] Abstract of an article by Th. Ribot (*Revue Philosophique*, February, 1888). See *Science*, Dec. 2 and 16, 1887.

but is only an accentuation of the sixth, with perhaps a deeper loss of consciousness. Here the mind is reduced to a single point, attention is sharpened to the finest focus, and this extreme contemplation seems to be an exception to the dictum of Hobbes, that to constantly think the same thing is not to think at all. Such extreme ecstasy is a rare phenomenon: Plotinus is said to have attained it only four times, and Porphyry but once.

The weakening of the attention is seen in an extreme form in mania which presents a general and permanent exalted excitability of the psychic life. The general diffusion of energy is equally apparent in the prodigality of movements, with often an insensibility to fatigue. No co-ordination of the mental energy requiring an effort of the attention is possible. The same is seen in hysteria, in sleepy conditions, in drunkenness, in children. These semi-morbid states well illustrate the motor element in attention. The power of directing the delicate movements that accompany attention is lacking, and with this the attention itself is weakened. One sees in the effects of intoxication the loss of power over the finer muscles, then over the coarser ones, both accompanied by an impossibility to attend to thoughtful ideas, and then to mental impressions of the simplest kind. In sleep there is to a slight degree a direction of the attention, for the sleeper is more easily aroused by one kind of stimulus than by another; but in general the power of attention is nearly lost. If we pass from the cases in which the power of attention has been lost by disease, to those in which it was never developed, we have a difference of degree alone. Idiots, again, are found incapable of directing their finer muscles, and in extreme cases cannot walk; and the most successful mode of approach to the minds of such defectives has been found to be through the muscles.

By way of *résumé*, we may speak of attention as a prevalent attitude of mind. It may be represented by a straight line bifurcating at either end. In the centre we have the average spontaneous attention: as we proceed to the right, the attention increases in intensity, passing into strong spontaneous attention, then into preoccupation, revery, then into a weak insistent idea. Here the line divides, passing into the two extremes, — a fixed idea on the one side, and ecstasy on the other. Beginning again with the normal, and going to the left, we have voluntary attention as an organic mental habit; and as this decreases, it is of only average power, then it becomes weak, and finally passes into the extreme loss of attention, which may be temporary and acquired on the one hand, or permanent and congenital on the other. These are simply various types: in reality, all kinds of intermediate forms abound.

UNCONSCIOUS CEREBRATION.— In the *Popular Science Monthly* for March, Mr. Francis Speir analyzes the returns to a list of questions quite extensively circulated by him, relating to the unconscious activity of the mind. The questions ask, for instance, of the power of recalling a forgotten word or sense-impression while thinking of something else, or perhaps in sleep; of the power of going through a more or less simple logical process under similar conditions; and of the working-out of original ideas (composition of verses, solution of a problem, new modes of regarding a series of facts, and the like), especially of feats of this kind performed during sleep. The answers unmistakably show that the unconscious learns many an art from our conscious selves without the teacher knowing it; and the relative frequency of really respectable performances going on in sleep is larger than one would, *a priori*, expect.

BOOK-REVIEWS.

The American Journal of Psychology. Vol. i. No. 2, February, 1888. Ed. by G. STANLEY HALL. Baltimore, Murray.

THE coincidence by which this publication and the third part of the Proceedings of the American Society for Psychical Research (reviewed in the last number of *Science*) come to hand at the same time suggests a few considerations regarding the growth of the scientific study of mental phenomena in this country. It does not seem at all hazardous to predict that the 'new psychology' has come to stay, and that nowhere does it give more satisfactory evidence of its power to systematize the various interests of students of mind, and to invigorate with a new life all such topics as had relapsed into the blissful slumber of a final settlement, than in this country. The *Journal of Psychology* comes forth as the distinct organ of the strictly technical and controllable study of all such phenomena as from one point of view are of important interest to the psychologist. In so doing it may incur the criticism of those who see in this step the incorporation of psychology in physiology and psychiatry; but apart from the fact that it is at present extremely difficult to foresee what will and should be the boundaries of that science, it is getting more and more generally admitted that a science takes its character quite as much from the point of view from which it regards convenient groups of the facts of nature as from the particular class of phenomena it takes into account. Moreover, by accenting the importance of the 'specialist' study of psychology, as also by emphasizing the value of a broad view of biological facts for the study of human development, it serves to convince of the error of their ways that throng of dilettanti who regard this as the proper field for their lawless rovings, as well as to indicate the difficulty, if not the impossibility, of a single instructor representing the entire field of philosophical thought.

The work of the American Psychic Research Society inevitably suggests comparison with that of the English society, devoted to the same purpose, and bears this test with great credit to itself. Judicious caution, careful reconnoitring of the general field, attention to details, and an appreciation for the extreme 'slipperiness' of interpretation in this kind of research, characterize the work of the American society. Apart from any interest in the final decision of the questions uppermost in the minds of its members, it is gathering facts of value to the psychologist, and appreciates that its field of work is closely related to that of other specialties, and cannot be carried on without a special knowledge of the possibilities of deception, of the mental traits of semi-morbid individuals, and so on. If one considers the wide-spread and intelligent interest in psychology represented by these two publications, it seems very strange that our best educational institutions have made so little provision for the representation of this branch of science upon their several curricula.

The opening article in this second number of the *Journal of Psychology* is by Dr. H. H. Donaldson, and treats of the relation of the recent researches in neurology to psychology. As the anatomical analysis of the nervous system does in some rough manner bring into rational order many of its functions, it is natural to expect that a deeper knowledge will increase the significance of this co-ordination of structure with function. Again: this co-ordination itself is subject to an evolution, and the anatomical homologue of a certain organ in an animal higher in the scale does not necessarily mediate the same functions as in the lower animal. Man has not only more cortex, but exercises a proportionally larger number of functions with his cortex than other animals.

A paper of great interest is that by Dr. Edward Cowles, upon 'Insistent and Fixed Ideas.' Under this head, Dr. Cowles introduces the detailed and systematic study of the operations of a disordered mind as a worthy object of investigation. The logic that draws conclusions at once analogous and yet opposed to those of common sense; the peculiar association of ideas that brings into connection facts and notions normally joined only in the uncontrolled visions of dream-life or the fictitious world of children; the strong tendency for abstract notions usually simply allowed to stroll through the chamber of consciousness, and be gazed at as a curiosity, to lodge themselves there, and acquire a reality that leads to violent and sometimes dangerous action; and the entire process still appreciated as something abnormal, something to be resisted, — all this is most graphically illustrated in the remarkable case described by Dr. Cowles. It is impossible to outline the history of this instance of a 'fixed idea,' as so much of its value depends on the recognition of the gradual evolution of the morbid from insignificant eccentricities.

The final paper in the series is a detailed criticism, by Dr. Joseph Jastrow, of the methods employed in experimentally determining the accuracy of the several senses. The object of the paper is to rescue this kind of experimental work from the various loose and uncritical processes which it has of late employed.

Besides the original contributions, there is a vast number of reviews, abstracts of papers, notes, etc., covering a variety of topics.

A Text-Book on Roofs and Bridges. Part I. Stresses in Simple Trusses. By MANSFIELD MERRIMAN. New York, Wiley. 8°. $2.50.

THIS work of Professor Merriman exhibits in a remarkable degree the clear, logical arrangement and concise style which characterize his writings on engineering and mathematical subjects.

The preparation of suitable text-books of applied science, and especially text-books on engineering subjects, for students of technical schools, at the present day, is an art that demands something more than a critical knowledge of the subjects discussed. It involves also, in the highest degree, a true conception of the art of teaching; and it may almost be laid down as a rule that the most successful teacher is best fitted to prepare a text-book on the subject which he teaches.

Admirable works there may be on particular branches of engineering: for example, works in which abundance of detail and illustration, the presentation and solution of intricate and unusual problems, and the introduction of whatever may elucidate the subject, furnish to the investigator or professional engineer most valuable and instructive information, but which may be quite unsuitable for the daily use and instruction of the undergraduate student.

During the period of the life of a student when his habits of thought and investigation are forming, it is of the utmost importance that he should become thoroughly imbued with the rational principles and processes of thought which will make him an independent thinker and investigator.

In this work the plan adopted for the computation of stresses in the members or parts of roofs and bridges, is, to use Professor Merriman's own words, "The principles and methods are first established, and then numerous examples are fully worked out to illustrate them and their application to different forms of trusses, while a number of problems are stated for the exercises of students."

This plan is faithfully carried out, the mathematical treatment of the principles and methods being clear and concise, and free from complications.

Professor Merriman's work on the 'Mechanics of Materials,' in the same style, and with similar arrangements, was unsatisfactory only in this, that it seemed to end in the middle of the subject, trussed or braced structures being left out; but the addition of the present work supplies the deficiency, and the two together will now constitute a complete work, admirably adapted to use in the higher technical schools.

Report of the Commissioner of Education for 1885–86. Washington, Government. 8°.

THIS report is the first issued by the new commissioner, Mr. Dawson, and is nearly, if not quite, as far behindhand in its appearance as its predecessors. We believe that the blame for this is to be laid at the door of the Government Printing-Office, at present the most inefficient department of the public service. In arrangement it is far superior to the bulky and confused reports issued by Mr. Eaton. The classification of the statistics, and their mode of treatment, mark a decided advance on what we have been accustomed to. The summary of State school laws is a valuable feature, as are the particularly useful statistics in Appendix X., dealing with education in foreign countries. This report, though good and useful, shows by its failures how essential some revision of the method of classifying educational statistics is. It is the task of a lifetime to extract from them, as at present presented, any answers to a score of pressing and important questions. The commissioner of education should have the power to inaugurate and carry through this much-needed reform.

Elizabeth Gilbert and her Work for the Blind. By FRANCES MARTIN. New York, Macmillan. 12°.

THE subject of this biography was the daughter of the principal of Brasenose College, Oxford, afterwards Bishop of Chichester. She was born in 1826, and was made blind at the age of three by an attack of scarlet-fever; but she was a girl of more than usual intelligence and energy, and, under careful instruction, became a well-educated woman, knowing French, German, and Italian, as well as vocal and instrumental music. She learned also to write a very legible hand; but written arithmetic was difficult for her, though she reckoned easily and accurately in her head.

During her childhood and youth she was always treated, both in her studies and in her plays, as nearly as possible like her sisters; but when she became a woman, and her sisters one by one married and left home, she began to feel her loneliness, and especially to feel that there was no field of usefulness open to her. But having received a legacy from a lady friend, which made her pecuniarily independent, she soon discovered work to do. She saw and keenly felt the difficulties that blind persons have in getting employment, even if they have learned a trade; and she undertook to furnish such employment, so far as her resources would permit. She first opened a store for the sale of goods made by the blind, employing a blind man as manager, she herself assuming the pecuniary responsibility, and meeting all deficiencies at first out of her private purse. To the store a factory was soon added, and the whole placed in charge of an association, which ultimately developed into The British Association for promoting the General Welfare of the Blind. Miss Gilbert was also active in serving the cause of the blind in other ways, so far as she had opportunity to do so; but we must refer our readers to the biography itself for the details of her work. She died in 1885. This story of her life is well and simply told, and we commend it to those who are interested in philanthropic work.

The Orbis Pictus of John Amos Comenius. Syracuse, Bardeen. 8°.

IT gives us a startling conception of the antiquity of Harvard College to recall that this educational classic, which so many persons associate with the middle ages, was written by a man who was solicited to accept the presidency of that institution. Mr. Bardeen deserves the hearty thanks of all educators for reproducing the famous work, and issuing it at a reasonable price. The paper, the binding, the type, are all appropriate. The cuts are unusually clear, and are taken from the copperplates of the edition of 1658; the Latin text is taken from the same edition. The text for the English translation is taken from the English edition of 1727, in which for the first time the English words were so arranged as to stand opposite their Latin equivalents. The cuts are here reproduced by the photographic process, and are not retouched or altered in any particular. We trust the *Vestibulum* and the *Janua* may be similarly reproduced at an early day.

Modern Theories of Chemistry. By LOTHAR MEYER. Tr. by P. Phillips Bedson and W. Carleton Williams. London, Longmans, Green, & Co. 8°.

WHILE editions of 'Die Modernen Theorien der Chemie' have succeeded one another in the original to the number of five, the English-speaking public has waited more than a score of years the opportunity to read in the vernacular a work which, perhaps more than any other of the period, has been influential in broadening and harmonizing the ideas of chemists as to the meaning and connection of the throng of facts which busy workers have amassed. The first edition of this work was projected and issued a quarter of a century ago with the purpose of bringing about just valuations of the theories and hypotheses then in vogue but variously estimated, and of showing the suggestive importance of working hypotheses to investigators. The reception of the edition was such (though the author was so modestly diffident of success, previous to publication, as to abandon a personal dedication which had been determined upon) that two more were published in the same form; and a fourth, revised and rewritten to meet the requirements of the time, was issued, only to be succeeded immediately by the fifth edition, upon which the translation now before us was based. In its present form, the book has assumed more of the character of a handbook or book of reference, and on that account the absence of an index is the more to be regretted. Of works merely elementary, and devoted to the representation of accepted theories without very much balancing of the evidence which has led to their establishment, we have in English several very good examples; but with a single exception (Muir's 'Principles of Chemistry'), and that of comparatively recent production, there has been no work on theoretical chemistry, accessible to the student whose only language is English, of any thing like the breadth of this. Its plan embraces not only the account of the latest development of chemical theories, but also the more important empirical data upon which the theoretical conclusions are based. Of the three parts into which it is divided, the first discusses the atomic and molecular hypotheses, including such topics as the law of Avogadro, Dulong and Petit, and Mitscherlich; the limitations of these laws, and the causes of observed deviations therefrom; and the periodicity, atomic weights, and properties. The second part, treating of the statics of the atoms, or "the doctrine of the equilibrium of the atoms in their combinations with one another," deals with the forms of combination, the law of atomic linking, and valency, or capacity for saturation. The third part is concerned with the dynamics of the atoms, or "the doctrine of chemical change;" and under this head is put an account of the connection of mechanical disturbance, heat, light, and electricity, with chemical change, and a discussion of the influence of mass action and of the stability of compounds as dependent upon atomic composition and interaction. Careful and cautious weighing of evidence is obvious thoroughout the work; and while the value of hypotheses, regarded simply as approximations to truth as well as aids to work, is insisted upon, stress is laid upon the need of proceeding with judgment, and of keeping separate, so far as may be, those theoretical considerations which are the abstract expressions of observed facts, from hypothetical assumptions which show an appearance of probability which may or may not be lasting. To the chemist who wishes to keep up with the tide, a knowledge of the German language, to the point of being able to follow the current of chemical events in Germany, is a matter of necessity, and most chemists are doubtless familiar with the original of the volume before us; but, for the student just entering the real work of chemistry, this book seems to us the most important which has appeared in English in many years.

The Art of Projection. By A. E. DOLBEAR. Boston, Lee & Shepard. 12°.

THIS is a new edition of a well-known book, first issued about ten years ago. It has been revised, and contains some important additions, especially a series of experiments on vortex-rings. Projection has come to be so extensively employed, not only as a means of illustration, but often as an aid to research, that many books would be required to describe the uses to which it may be put. Professor Dolbear's book will always be useful as a guide to the *technique* of port-lumières, lanterns, sources of light, etc., and it contains a well-selected series of experiments suitable for presentation by this method.

The Art of Investing. By a New York broker. New York, Appleton. 16°.

THIS is the sort of book that will find many readers; for although few people, relatively speaking, can invest, yet many more hope to be able to some day, and every one likes to know how it is done. To many its perusal will be like a glimpse through the curtain at a nobleman's ball to a street gamin. It is cleverly written, and puts in a plain, practical sort of way a great many statements that all who invest believe, but few follow. The truth is, that speculation is more or less a disease, and, when it seizes one, it is apt to run its course, cautions and antidotes to the contrary notwithstanding. For this reason a book of this sort is of little value. Many persons who read it will think that they know better than the author what securities are safe, and what are not. Only personal experience and personal loss will convince them.

Under the head of investing, the author discusses the various investment securities in order, beginning with government bonds. The story of State and municipal repudiation is a sad and disgraceful one, and in consequence the confidence in a majority of the securities issued by State and municipal authority has long since been shaken. Many readers will be interested in what is said about farm loans, and will applaud the writer's conservative yet fair judgment concerning them. Under the head of speculating, the New York Stock Exchange receives a severe castigation, but one which is thoroughly deserved. It is beyond question that that far-famed institution has done more harm to the legitimate business interests of the country than any other single influence. If people can only be induced to keep away from it a little longer, it will die of inanition. Gambling is not very profitable unless some rich outsiders participate in the game. The book will unquestionably be widely read: it is almost too much to expect that it will be widely followed.

NOTES AND NEWS.

DR. BILLINGS of the Army Medical Museum will signalize the removal to the new building near the National Museum by the preparation of an illustrated catalogue. It will contain drawings of all the crude and wet specimens of tumors, cancers, gangrenes, etc., and other objects on exhibition in the museum, besides micro-photographs of morbid tissues prepared by Dr. W. M. Gray, the microscopist of the surgeon-general's office. Each picture will be accompanied by a short description of the object illustrated, but there will be no discussion of theories. The work, when completed, will constitute a complete pathology, and will be a most valuable text-book for students and physicians.

— Prof. C. H. Hitchcock of Dartmouth College has just returned from the Indian River region of Florida, where he has been studying the tracks of animals on the sand of the seashore in the hope that they might assist in the interpretation of the fossil foot-marks found in the sandstone of the Connecticut valley in Massachusetts. It may be remembered that the late Prof. Edward Hitchcock of Amherst College devoted a great deal of study to these fossil foot-marks, and published in 1858 a report in which he described, and illustrated by plates, a hundred and nineteen species of insects, worms, mollusca, crustaceans, etc., supposed to have been represented by them. Prof. C. H. Hitchcock is pursuing the same line of study in which his father worked so long, and the result of his recent visit to Florida is that he leans more and more to the opinion that the fossil tracks are chiefly those of crustaceans.

— The February number of the *Journal of the Royal Geographical Society* contains an interesting report of William John Steains's journey to the Rio Dôce in Brazil, and its northern tributaries. The traveller, who first went out to South America in connection with a commercial undertaking and the formation of railways, after having accomplished his duties in that direction, undertook the exploration of this river, only the lower part of which was known, although the territory is so near Rio Janeiro. It is principally the difficulty of navigation of the river, which breaks through the coast range in wild rapids and cataracts, and the hostility of the Botocudo, who inhabit this part of the coast, which prevent its being colonized. The country is covered with primeval forest of wonderful beauty and density, and only a few settlements exist on or near the banks of the Rio Dôce. Steains's paper is accompanied by a valuable map giving the results of his traverse surveys. A comparison with other maps of the river shows their great inaccuracy. Steains's geographical explorations, which lasted for eight months, were comparatively thorough. He not only explored the main river, but ascended several of its northern tributaries, particularly the Rio Sao José, which joins the Rio Dôce at Linhares, and several others. By these trips our knowledge of this region is materially increased. On the Rio Pancas he fell in with a sept of the Botocudo, with whom he lived for a month. His observations on this tribe do not contain any new information, and are not so thorough by far as Ehrenreich's study of these tribes, which were mentioned in No. 239 of *Science*. The exploration of the tributaries of the Rio Dôce, as well as that of the main river, was made very difficult by the numerous cataracts which had to be passed by long portages. From Steains's paper it would appear as though a considerable amount of private and government surveying was going on in Brazil; but very little definite information reaches us so far, and our maps of the greater part of Brazil are still very defective, being founded on very old observations and indefinite reports. From Steains's paper it does not appear whether his map is based upon astronomical observations, or a compass survey.

— Thomas Gray of the University, Glasgow, Scotland, has accepted the chair of dynamic engineering in the Rose Polytechnic Institute, Terre Haute, Ind., and will begin his work next September. Professor Gray is well known in this country for his researches in electricity, seismology, etc., and his work for several years with Sir William Thomson on instruments of precision for electrical measurement.

LETTERS TO THE EDITOR.

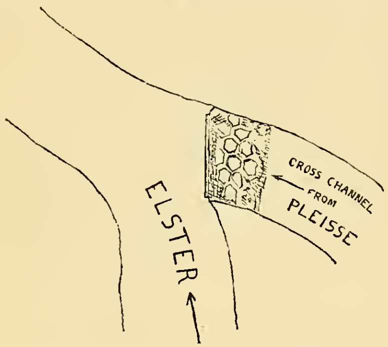
⁂ Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.

Twenty copies of the number containing his communication will be furnished free to any correspondent on request.

The editor will be glad to publish any queries consonant with the character of the journal.

Effect of Pressure on Ice.

AN instance of hexagonal figures resulting from pressure seems to be furnished by the ice-masses which were observed in a cross-channel connecting the Pleisse and the Elster at Leipzig. The ice, which was partially dissolved by thawing weather, had been stopped by a beam held by chains across the outlet of the cross-channel.



This beam was in constant vibration, being influenced by the currents of both streams, that of the Elster being the more active. Hence the ice was constantly subject to gentle shocks as it was pushed up stream by the beam, and as it came back again against it. The ice next to the beam, along the walls, which were of cut stone, and farthest from the beam, was of a slushy consistency, but the central portion appeared as roughly shaped hexagons.

The Elster channel is about twenty feet wide, the other about twelve. C. H. L.

Leipzig, Feb. 18.

Vermin-Eaters.

In re the article on vermin-eaters (*Science*, March 2) see BANCROFT, *Native Races of the Pacific States*, ii. p. 234; i. pp. 431, 188; 'The voyage of Johannes de Plano Carpini unto the North-east parts of the world in the yere of our Lord, 1246,' in R. HAKLUYT, *The Principal Navigations*, etc. (London, 1599–1600), i. p. 59; E. BRYANT, *What I Saw in California* (New York, 1849), p. 154; JAMES COOK, *Voyage to the Pacific Ocean, etc., in the Years* 1776–80 (London, 1784), ii. p. 305; *Annual Report of the Smithsonian Institution for* 1866, p. 306; 'The Eastern Tinneh from a MS. by Bernard R. Ross, Esq.,' in GEORGE GIBBS, *Notes on the Tinneh or Chepewyan Indians of British and Russian America; The Travels of Girolamo Benzoni in America, in* 1542–56, translated and edited by Admiral W. H. Smyth, 1858 (*Publications of the Hakluyt Society*, xxi.), p. 9; J. J. LABILLARDIÈRE, *Relation du Voyage à la Recherche de La Pérouse fait par ordre de l'Assemblée Constituente, Pendant les Années* 1791, 1792, *et Pendant la 1ère et la 2de Année de la République Françoise* (Paris, 1799), ii. p. 50; W. KIRBY and W. SPENCE, *An Introduction to Entomology, or Elements of the Natural History of Insects* (Philadelphia, 1846), p. 136; A. D. RICHARDSON, *Beyond the Mississippi* (Hartford, 1867), p. 190; ANDERSSON, *Lake Ngami*, p. 17.

E. LEWIS STURTEVANT.

South Framingham, Mass., March 3.

Landing Eskimo Boats.

I HAVE just heard from Mr. Henry Elliot of a device invented by the Eskimo for the purpose of landing the skin boat called 'oomiak.' It is probably the most primitive form of 'gridiron' or 'way' known in the world. The Eskimo float is the skin of a seal taken off entire, and arranged so as to be inflated, and fastened to the end of a harpoon-line. This use of the float is well known.

Mr. Elliot informs me that a party of Eskimo travelling in the oomiak take along several of these floats, and when the boat is to be landed upon a rough beach, in order to avoid abrasion by the pebbles, two or three of the floats are inflated, or filled with water; and when the oomiak is about to land, one of these floats is placed under the bow of the boat on the beach. As the oomiak is drawn ashore, other floats are placed along in front of No. 1; so that a series of them acts like a set of rollers, or crib, on which the bottom of the oomiak rests. It is to be understood that these open boats carry frequently a great deal of freight in addition to the passengers: therefore, after the men and women have gotten out, the boat, with its freight, would have considerable weight. If there were no means of easing the bottom over the pebbly beach, considerable damage would be done by friction.

In the study of inventions, this is a very important link in the evolution of those processes which have resulted in the modern dry-dock. While speaking of the float and its functions, it may be of interest to state that one or two of them raised on the top of a pole or harpoon-shaft is a signal that the inmates of the boat are anxious to traffic. This I have also from Mr. Elliot. O. T. M.

Washington, D.C., March 7.

Dried Heads among the Jivaros.

IN the National Museum are two shrunken heads, with nearly perfect features, long, glossy hair, and having the mouth closed by means of a long fringe of cords. There is a doubled braided cord fastened to the vertex for suspension, and others hanging downward for the attachment of colored feathers.

There seems to be some confusion in literature about these heads, and I write this note partly to state what I have learned, and partly to ask for light.

Dried heads are preserved by many South American tribes. Fletcher and Kidder (*Brazil*, 473, illustr.) say,—

"The Tamoyos dwelt formerly in the provinces of Rio Janeiro and Minas Geraes, but, being harassed by colonists, were persuaded by the eloquence of Chief Jappy Assu to emigrate north. They migrated more than three thousand miles to the mouth of the Madeira. Their descendants are now between the Tapajoz and the Madeira, among the lakes and channels of the Tupinambas. They are now called the Mundrucus, the most warlike Indians in South America. They live in villages, in each of which is a fortress where the men sleep at night. This building is adorned within by the dried heads of their enemies decked with feathers."

But the Jivaros, who dwell on the Napo River in Ecuador, do more than dry the heads. They remove all the bones, and shrink the heads until they are no larger than a lady's fist, and are as hard and glossy as polished ebony.

There is an account which says that these people, when they had killed a brave enemy, cut off his head, pounded it with clubs until all the bones within were beaten to a jelly, then removed the bones, and smoked the head until it shrunk to its present proportions. This has always seemed unreasonable, because the pounding would also destroy the skin.

Mr. Charles H. Knight, an American citizen, went to the Napo country, one hundred and eighty miles east from Quito, in 1871, and spent five years there in business. He procured one of these dried heads, which is now in the United States National Museum, from the Achualas, a band of Jivaros, through an old Indian who had seen the preparation. The heads thus treated are always trophies taken from a slain enemy. An incision is made quite through the skin around the neck, well down toward the shoulders. The skin is then drawn off over the head, just as one would do in flaying an animal, cuttings being made whenever muscular adhesion made it necessary. The features are thus left intact. The skin is then soaked in an infusion of some kind of herb, which Mr. Knight did not procure. The second step consists in filling the skin with hot pebbles and sand, over and over, until it is quite shrunken and dry. The soaking in the decoction, and the shrinking and drying, are alternately practised until the trophy is reduced to the desired proportions. The mouth is then sewed up, a cord is passed through the top of the head, and the specimen is hung up in the smoke.

O. T. MASON.

Washington, D.C., March 9.

BOOK-NOTES.

— As one of a series of efforts to encourage the reading of good books among young people in the schools, E. L. Kellogg & Co., New York, have just issued a classified list of the one thousand best books for school libraries. It is based on the lists of Dwight L. Holbrook of Clinton, Conn., and James M. Sawin of Providence, R.I., teachers largely interested in the same work.

— In the *Andover Review* for March, Dr. Edward W. Bemis writes upon 'Restriction of Immigration,' arguing forcibly for its need, reviewing methods for its accomplishment, and pointing out one which is deemed practical and simple.

— P. Blakiston, Son, & Co., announce for publication 'Chemical Technology, a New and Complete Work,' edited by Charles E. Groves, F.R.S., and William Thorp, B.Sc., F.I.C., in about eight volumes, with numerous illustrations, each volume sold separately. Vol. I., 'Fuel,' by Dr. E. J. Mills, F.R.S., professor of chemistry in Anderson College, Glasgow, and Mr. F. J. Rowan, assisted by an American expert, is nearly ready.

— The first of two papers by James Baldwin, entitled 'The Centre of the Republic,' will appear in *Scribner's Magazine* for April. The special object of these essays is to show the social and intellectual phases of the development through which the people of the West have advanced, and for the first time clearly to set forth the great intellectual activity of that region in contrast with the industrial prosperity which has been so much written about.

— Prof. W. G. Summer, in an article on 'The First Steps Toward a Millennium,' in *The Cosmopolitan* for March, says that the questions that confront the student of social science narrow themselves down to the question of population. There are not, perhaps, too many people who are sound physically and mentally, but there are too many people who ought never to have been born because of their mental and physical feebleness.

— P. Blakiston, Son, & Co., Philadelphia, have just ready the third edition of Yeo's 'Manual of Physiology for Junior Students,' somewhat enlarged, and with twenty new illustrations.

Calendar of Societies.

Philosophical Society, Washington.

March 3. — F. W. Clarke, The Determination of Atomic Weights; J. W. Spencer, Notes on the Drift North of Lake Ontario; C. A. Kenaston, Physical Features of a Portion of the British North-west; John Murdoch, An Arch of Ice formed by Horizontal Pressure.

National Geographical Society, Washington.

March 2. — W. E. Curtis, Patagonia.

Biological Society, Washington.

March 10. — F. W. True, Changes in the Catalogue of North American Mammals since 1877; George Vasey, Foreign Trees and Shrubs Cultivated in the District of Columbia; Theo. Gill, The Classification of Cottoideus Fishes; C. Hart Merriam, Description of a New Species of American Skunk; Robert T. Hill, The South-western Termination of the Atlantic Timber Belt.

Engineers' Club, Philadelphia.

Feb. 18. — W. H. Ridgway, An Illustrated Description of a Direct-Acting Steam-Crane; Fredc. H. Robinson, An Account of the Manufacture of Sewer-Pipe by the Delaware Terra Cotta Company; L. M. Haupt, The Relative Merits of Salt Glazing and Slip Glazing with Albany Clay; Henry G. Morris, How Not to Do It.

Natural Science Association, Staten Island.

Feb. 11. — L. P. Gratacap, Boiling Springs.

Society of Arts, Boston.

March 1. — George M. Bond, Standards of Length, and their Practical Application.

Boston Society of Natural History.

March 7. — W. O. Crosby, Geology of the Black Hills of Dakota.

Missouri University Club, Columbia.

March 5. — Judge P. Bliss, Origin of Law.

Purdue Scientific Society, Lafayette, Ind.

Feb. 27. — H. L. Bolley, Starch Granules; S. Coulter, Germ Theory of Disease.

Publications received at Editor's Office, Feb. 20–March 10.

ALDEN'S Manifold Cyclopedia of Knowledge and Language. Vol I. A to America. New York, J. B. Alden. 630 p. 12°. 50 cents.

BARNARD, C. First Steps in Electricity. New York, C. E. Merrill & Co. 133 p. 12°. 75 cents.

BAYLEY, W. S. A Summary of Progress in Mineralogy and Petrography, in 1887. Madison, Wis., The Author. 42 p. 12°.

CHAMBERS'S ENCYCLOPÆDIA. New ed. Vol. I. A to Beaufort. Philadelphia, Lippincott. 824 p. $3.

CLODD, E. The Story of Creation. New York, Longmans, Green, & Co. 242 p. 12°. $1.75.

DAWSON, J. W. The Geological History of Plants. New York, Appleton. 290 p. 12°.

DEWEY, F. P. Photographing the Interior of a Coal-Mine. Washington, The Author 6 p. 8°.

FORBES, G. A Course of Lectures on Electricity. New York, Longmans, Green, & Co. 163 p. 12°. $1.50.

FRANÇOIS, C. von. Die Erforschung des Tschuapa und Lulongo. Leipzig, Brockhaus. 220 p. 8°. (New York, Stechert, $2 20.)

GAGE, A. P. Introduction to Physical Science. Boston, Ginn. 339 p. 12°.

GALLAUDET, E. M. Life of Thomas Hopkins Gallaudet. New York, Holt. 339 p. 12°. $1.75.

HAUPT, L. M. The Physical Phenomena of Harbor Entrances. Philadelphia, The Author. 23 p. 8°.

HEEBNER, C. F. Manual of Pharmacy and Pharmaceutical Chemistry. New York, The Author, 5 Gold St. 12°. $2.

HINRICHS, G. Re-election or Re-organization. Iowa City, Io., The Author. 28 p. 8°.

INVESTING, The Art of. By a New York broker. New York, Appleton. 198 p. 16°.

LITERATURE, an Illustrated Weekly Magazine. Vol I. No. 1. New York, J. B. Alden. 24 p. 12°. $1 per year.

MCADIE, A. William Ferrel. St. Paul, Minn., The Author. 8 p. 8°.

MACGREGOR, J. G. An Elementary Treatise on Kinematics and Dynamics. New York, Macmillan. 512 p. 12°. $2.60.

MARTIN, Frances. Elizabeth Gilbert and her Work for the Blind. New York, Macmillan. 307 p. 12°. $1.75.

MEYER, L. Modern Theories of Chemistry. Tr. by E.P. Bedson and W. C. Williams. New York, Longmans, Green, & Co. 587 p. 8°. $5.50.

MOREHEAD, Mrs. L. M. A Few Incidents in the Life of Prof James P. Espy. Cincinnati, Robert Clarke & Co. 22 p. 12°.

PEREZ, B. L'Education Morale dès le Berceau. 2d ed. Paris, Baillière. 320 p. 8°.

PROPHYLACTIC, The. Vol. I. No 1. New York, M. B. Playter & Co. 40 p. 8°.

SMITH, C. A Treatise on Algebra. New York, Macmillan. 571 p. 12° $1.90.

STIRLING, W. Outlines of Practical Physiology. Philadelphia, Blakiston. 309 p. 12°. $2.25.

SWEDENBORG, E. The Soul, or Rational Psychology. Tr. by Frank Sewall, A.M. New York, New Church Board of Publ. 388 p. 8°. $3.

TEACHER, The. Vol. I. No. 1. *m.* New York, Teacher. 16 p. 4°. 10 cents.

WALKER, J. The Theory and Use of a Physical Balance. New York, Macmillan. 40 p. 8°. 90 cents.

WATERS, C. A. An Explanatory Digest of Professor Fawcett's 'Manual of Political Economy.' New York, Macmillan. 77 p. 12°. 70 cents.

WISSMANN, H., WOLF, L., FRANÇOIS, C. von, and MUELLER, H. Im Innern Afrikas. Leipzig, Brockhaus. 457 p. 8°. (New York, Stechert, $5.50.)

YEO, G. F. A Manual of Physiology. 3d ed. Philadelphia, Blakiston. 758 p. 12°. $3.

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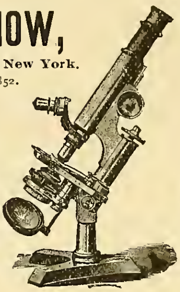

SCIENCE

FRIDAY, MARCH 23, 1888.

Col. Carroll D. Wright, chief of the Bureau of Labor Statistics, is now engaged in the preparation for the work of the coming year. The subject he proposes to have investigated is the actual earnings of the railroad employees of the country. To ascertain this, he does not propose to be content with averages, but will ascertain from the pay-rolls of the companies just what each man in each grade of employment receives during the year. From this he will be able to determine what the actual earnings in the several departments are. The defect of all statistics of this kind, except those gathered by Colonel Wright in Massachusetts, is that they have dealt chiefly with averages, which really give no idea whatever of what the income of the working-people is. Dividing the total amount of wages paid in a month, or a year, by the total number of employees, produces a result that is of little or no value in economics. As the proportion of high or low priced employees is increased or diminished, the average will be raised or lowered, though the actual earnings of an individual in any particular department may not be changed. The series of reports now issuing from Colonel Wright's office are of more scientific value than any statistics heretofore published by the government, excepting the census reports. They are collected in accordance with a carefully devised and skilfully worked-out plan prepared by Colonel Wright himself. The agents employed are experienced and trained, and the results are calculated to show the actual facts. In the discussion of these facts, Colonel Wright has no preconceived theories to establish, no partisan purpose to serve. The one object is to find the truth, and, that discovered, the purpose of Colonel Wright's work is accomplished.

The United States Department of Agriculture has issued the third part of the report on foods and food adulterants. It treats of fermented alcoholic beverages, malt liquors, wine, and cider, and represents a vast amount of work by C. A. Crampton, the chemist, and his assistants. The opening sentences of this report are calculated to excite a good deal of thought and reflection. They are as follows: "The production of malt liquors in this country as an industry is second only in importance to the production of breadstuffs. Their consumption is steadily on the increase, as is also the amount consumed in proportion to other kinds of alcoholic beverages." These facts are well illustrated by tables, from which a few figures will be selected. In 1840 there were consumed in the United States, 23,310,843 gallons of malt liquors. From that time until 1886 the amount of annual consumption increased, until during that year it had reached 642,967,720 gallons. In 1840 the consumption *per capita* of the population was 1.36 gallons, while in 1886 it was 11.18 gallons. During the same period the *per capita* consumption of distilled spirits has decreased from 2.52 to 1.24, or, in other words, the malt liquors have been driving out the distilled at the rate of about .05 of a gallon *per capita* each year, and supplanting them at the rate of about .38 of a gallon *per capita*. It is estimated that the amount expended for beer per annum is $304,852,683, placing the cost to the consumer at 50 cents a gallon. The annual cost to the consumer, of all liquors consumed, is placed at $700,000,000. And yet the statement is made that the United States, although holding her own in the quantity of distilled liquors consumed, is still far behind the other great nations in the consumption of the milder alcoholic liquors; and the statistics certainly bear out this statement. Thus in the United States there were consumed 11.18 gallons of malt liquors *per capita* in 1886: in the United Kingdom there were consumed 32.79; and in Germany, 23.78 gallons in the same period. In speaking of the enormous consumption of beer in the United States, Mr. Crampton says that there is no beverage that compares with it in the amount consumed by the people, except water, and possibly milk; and that but little supervision has been exercised over its manufacture and sale, except the rigorous enforcement by the government of its demands for a share in the profits. The processes of brewing, malting, fermenting, clarifying, and preserving are fully described in the report, and analyses are given of all the beers which are drunk in the United States. From these it would appear that the average amount of alcohol, by weight, is 4.63 per cent. Of thirty-two samples analyzed by the department, salicylic acid was found in seven. These were all bottled beers, one of them being imported. None was found in any of the draught beers. Of the nineteen samples of American bottled beers analyzed, six contained this acid. These six included the product of some of the largest breweries in the country, — beers that are used to a very large extent all over the United States. Whether the acid is added in the breweries where the beer is made, or by the local bottlers, could not be determined. The acid is added to prevent fermentation, and as has been shown by Dr. Bartley, formerly chief chemist to the Brooklyn Board of Health, the amount which beers contain is sufficient to be injurious to health. Of seventy samples of wine examined by Mr. Crampton, including champagne, burgundy, claret, sherry, sauterne, and other wines in common use, eighteen contained salicylic acid, and thirteen sulphurous acid, which had been added as such or in the form of a sulphite. One sample in forty contained one aniline dye-stuff, probably fuchsine: this was a California claret. In the analyses which were made of cider, some were found to contain as much as 8.09 per cent of alcohol by weight, the average being 5.17 per cent. These were all well-fermented ciders, and all bottled but one. In the 'sweet' or incompletely fermented ciders, the percentage of alcohol averaged 1.40, the lowest being 0.20, and the highest 3.46. No salicylic acid was detected in any of the ciders examined, and but one was adulterated. This was a bottled 'sparkling cider,' handsomely put up in neatly capped bottles, and of a clear, bright color. In it were found both bicarbonate of soda and a sulphite. This report is in its entirety a most valuable one, replete with information which is interesting to the general reader, as well as instructive to the scientist.

The State Board of Health of Illinois has been the pioneer in the movement to restrict the practice of medicine to those who are qualified. This policy has been based on a law passed by the Legislature of that State, giving to the board the sole power to grant licenses to physicians, without which the practice of medicine is illegal, and the offenders subject to a severe penalty. The law grants to the board the additional power of revoking licenses which they have previously granted. It has been hitherto supposed that there was no restriction on this power of revocation, but a recent decision of the courts in that State would seem to indicate that this power cannot be exercised without limitations. An Illinois physician having advertised in the newspapers, the State board revoked his license. The court maintains that the right to advertise one's business is a right to which every citizen is entitled, and that to deprive him of this right is unconstitutional, and that members of the medical profession cannot be discriminated against, any more than the members of any other profession or trade. This decision will, we presume, be appealed from, and the final result will be watched with interest.

WASHINGTON SCIENTIFIC NEWS.

Zuñi Mythology and Religion: a Valuable Contribution to Anthropology. — The Life-History of Tænia Pectinata: Does the Presence of this Parasite explain the Winter-Killing of Sheep? — The Function of the Bone in Anchoring Implanted Teeth: Result of Dr. W. M. Gray's Investigations. — Some Recent Discussions of Target-Shooting. — Obscure and Conflicting Phenomena of the Drift North of Lake Ontario. — Sources of Error in the Determination of Atomic Weights. — The Pristine Homes of the Indian Tribes of this Continent.

Zuñi Religion.

THE annual meeting of The Women's Anthropological Society, held March 8, was a memorable one in the history of that organization. The paper of the evening was read by Mrs. T. E. Stevenson, the president of the society, on the Zuñi religion; and the most accomplished anthropologists in Washington, who were present as guests, pronounced it, in the conversational discussion which followed, to be the best presentation of a savage religion yet written.

Introducing her subject, Mrs. Stevenson said, that, according to Zuñi tradition, all Indians entered this world in the far North-west, having ascended through three lower worlds before their advent here. "The Zuñi came to this world by the command of the Sun," she said, "who sent his sons, Ah-ai-u-ta and Ma-a-se-we (two little war-gods) as bearers of his message, and to guide them to his presence. They ascended from the lower world through a huge reed. Po-shai-yan-tka, the high priest of the Zuñi, followed immediately after the gods. The other priests came next in succession; then the eight original medicine orders and all carnivorous animals. Upon reaching this world, the Zuñi for the first time beheld the light of day, and they bowed to the earth, and hid their faces in fear. It was discovered by the light of day that the Zuñi possessed long, hairless tails, which Ah-ai-u-ta amputated with his stone knife. According to the word of the present priest of the warriors, the people also had long ears, reaching to the ground, which they rolled and tied up by day, while at night they served as a bed and covering.

"The Zuñi do not believe they existed in interior worlds as animal species, other than Zuñi themselves, with their great ears and hairless tails. The other animals could communicate with them as between man and man. These animals were superior to the Zuñi, and were then, as now, mediators between them and the gods. They held all medicine secrets, which they revealed to the Zuñi only after coming to this world."

Mrs. Stevenson then enumerated the medicine orders in the succession in which they reached this world. "These orders," she said, "also the priests of the cardinal points and others, brought many precious articles from the lower world, which they carried on their backs in sacred blankets, the E-to-ne being the most valued fetich they brought. The E-to-ne is a miniature sarcophagus, in which two frogs and two tadpoles, the first offspring of the frog, seeds of cotton, and other vegetation, are incased. On the top of this stone case are eight te-lik-yi-na-we, or plume-sticks, laid lengthwise, about an inch of each one projecting over the edge of the box. Between the eight plume-sticks is an ear of corn representing the mother-corn, or fecundity. The case is wrapped with a piece of ancient cotton cloth, and around the whole are strings of turquoise and ko-ha-qua beads. In some instances the E-to-na is so heavily wrapped with beads that nothing else is to be seen except the projecting ends of the plume-sticks. On the end of each stick a breast-feather of the eagle is attached, pendent, by a cotton cord of native manufacture. The Order of Rain has, in place of the E-to-na, a female stone image, eight inches high, — the Wi-ha-tsan-na Ah-win-tsi-ta, the great mother of all infants.

"The Order of the Ha-lo-o-que has, instead of the E-to-na, a stone knife, the destroyer of all enemies. This knife is about twelve inches in length."

After enumerating the other medicine orders, Mrs. Stevenson gave in very brief outline the story in connection with the forming of the Order of the Hunters, as follows: —

"A strange people were discovered by certain ancestral gods. Three of the gods were captured, and a battle was the result. The lines of the enemy were protected by the tCha-que-na, the keeper of all game: she passes to and fro, shaking a rattle. Great efforts were made to kill the woman, and, though many arrows pierced her breast, she still continued to walk, and shake the rattle. The war-god, Ah-ai-u-ta, finally declared she was carrying her heart in the rattle: he aimed his arrow at the rattle, struck it, and the tCha-que-na fell dead. It was now an easy matter to rout the enemy and enter their home, which they did, opening the wall that enclosed all game, permitting it to go where it would, and thus the game spread over the earth."

The stories of the origin of the other orders were also given briefly, and then Mrs. Stevenson continued the Zuñi account of their establishment in their present home, as follows: —

"Po-shai-yan-tka did not remain long with his people after reaching this world: he travelled with them for a time southward, then, separating from the main party, he, accompanied by the orders of the Ne-we-e-que and Shu-ma-a-que, his wife, I-ya-ti-ku (who was very beautiful and good), and all the animals that came to this world with him, travelled far to the east, then south. A long time was consumed in his journeying, and he built many villages on the way, and, finally reaching the Rio Grande, built houses in the cliffs. These the Zuñi locate as the line of Cavate houses west of the pueblos of San Juan and Santa Clara, in New Mexico. They extended some thirty miles along the right bank of the Rio Grande. These ruins are known to the Zuñi as the singing house of Po-shai-yan-tka; for it was here the animals gave to Po-shai-yan-tka their songs and medicine secrets, he in turn instructing the people. Po-shai-yan-tka, before separating from his people, gave to them the priest Yan-a-o-loo-a to be to them a father in his absence, he promising to return to them, wherever they might be. Old Zuñi priests say they are weary with watching for his return. The name of this departed priest is so reverently held by these people, that it is seldom mentioned excepting in prayer, and each day prayers of supplication are made for his return. This priest is believed by the Zuñi to be the Montezuma known in Mexican history.

"The Zuñi, led by the war-gods, travelled many years to the south, then east, stopping often to build villages, where they for a time lived. Besides the thirteen medicine orders of Zuñi, there is an order to which I referred in a paper previously presented before this society, — the Order of the Kok-ko, the mythological period. It will be remembered that I mentioned in that paper the transformation of a boy and girl upon a mountain-top, who had been sent in advance to look for a place on which to build a village. After the transformation, the youth descended to the plains below, swept his foot through the sands, and created a river and a lake, and in the lake a group of houses, the centre one being the great assembly-house for the Kok-ko. The first three gentes to cross this river were the Sand-hill Crane, Bear, and Corn. The women were afraid, and dropped their children into the water; and the little ones were transformed into ducks, snakes, lizards, etc., and afterwards changed into the Kok-ko, becoming ancestral gods. The three gentes who lost their children composed the Order of Wood, and this order, after becoming childless, determined to leave their party, and go in search of their beloved priest Po-shai-yan-tka. From this point the Zuñi advanced eastward some sixty miles, locating upon the present site of Zuñi. The present village, however, was built upon the old village after their return from a mesa near by, upon which they lived for a long period, and where extensive ruins are now to be seen.

"The Wood Order, after separating from the Zuñi, took first a northerly course, then easterly, reaching the Rio Grande, and passing down this river till they at last found the home of the much-longed-for father. During this journey they built four villages about equal distance from one another, remaining at each village four years, which words, however, according to Zuñi tradition, refer to periods of time. This order found the home of their father, Po-shai-yan-tka, guarded by formidable sentinels. The first was a mountain-lion decorated with two eagle-plumes, — one attached to the back of his neck, and one on top of his head. As the order approached, the mountain-lion arose and advanced, angry and growling; but upon the presentation of the plume-sticks, with which the order was provided, and their sprinkling upon him sacred meal, he became gracious, and invited them to enter into the house of his chief. Five other animals, sentinels, had to be propitiated in like manner — the bear, badger, white wolf, eagle, and mole — ere the Order of Wood reached the presence of the great priest. They were welcomed by Po-shai-yan-tka, who told them they must remain with him for a time, and be taught by him. Many years had elapsed since he had separated from his people in the far north-west, and there were many villages surrounding the home of the priest. Po-shai-yan-tka, desiring that others of the Shiwina or Zuñi should also be taught, commanded their presence through his messenger, the Lightning. Upon the arrival of the orders, Po-shai-yan-tka commanded all to gather into groups and listen attentively, for he was about to instruct them in all the medicine songs and dances, the songs to be sung in winter, and the songs for summer. The winter songs must not be sung when the sun was hot, nor must the summer songs be sung in winter time. Each group was provided with a pottery drum, vase-shaped, the opening covered with hide. But one drum-stick, the Nit-tsi-tKi, was used to each drum. This drum-stick was brought from the interior worlds by Po-shai-yan-tka, and, like all articles that came to this world with the Zuñi, is of special value and significance.

"The leader of each group beat upon his drum. All the Shiwina or Zuñi paid special attention, and heard the songs straight, and so remembered them. But the people of the many villages did not hear straight: therefore the songs sung by the Zuñi at the present time are the only authentic songs of Po-shai-yan-tka. He also gave to them all altars of wood and sand, instructing the people how to make them. The medicine and songs came from other animals, but knowledge of the altars sprang directly from Po-shai-yan-tka. In the heart of Po-shai-yan-tka the knowledge of all earthly things originated. The altars were strictly guarded by the animals during the season of instruction, and the people were commanded to have the altars they made guarded in the same manner, the animals assuming relative positions. And since that time these altars have been guarded by stone animals which were once living, but were converted into stone by the great fire that swept over the earth. Trees were likewise converted into stone. The size of the image depends upon the length of time the animal was subjected to the fire: the longer it burned, the smaller it became. Thus these people account for the diminutive size of their animal fetiches. The Zuñi returned to their home, bearing with them the promise of Po-shai-yan-tka's return. Po-shai-yan-tka then commanded the lion to make his home in the north for all future time, as the protector of the north. The bear he sent as protector of the west, the badger to the south, the white wolf to the east, the eagle to the heavens, and the mole to the earth. All other animals he scattered over the face of the earth."

The lack of space forbids giving in this abstract Mrs. Stevenson's exceedingly interesting description of the ceremonials of the different orders. Gaining the entire confidence of the Zuñi, she adopted their dress, painted her face, and witnessed all their secret rites. Speaking of the necromancy or magical arts of the Order of the Ooh-hoo-hoo-ooh-que, she says, —

"One of their tricks is for two persons to draw a rope to and fro across the body of another until it appears on the opposite side. Another is to pass two breast-feathers of the eagle through the flame of a lamp, bringing out two charred bits, and, after manipulating for a time, pressing the bits to their nude breasts, reproducing the feathers in all their original beauty. Mush is made and rolled into small balls, which are passed to the members of the order to eat. The *prestidigitateur* then dips two eagle-plumes in medicine-water, and sprinkled it upward, calling upon the eagle-god of the heavens to convert the mush into stone. The balls are again passed, when they are found to be as hard as stone. Again the plumes are dipped into the medicine-water, and sprinkled to the fire, with the request that the goddess reconvert the stones into mush. Hot water is made cold by the same process, with the feathers, and again heated by calling upon the goddess of fire."

The Wood Order are very clever at legerdemain. Mrs. Stevenson says, "When I first witnessed the swallowing of the knife, I was inclined to think it a ready trick. A youth approached the altar, and dipped the ends of two eagle-plumes into medicine-water, and, after touching his breast with the plumes, he danced wildly before the altar; then he reached behind the altar for his knife, which he held upward while he danced, at times distorting his body, and throwing himself almost prostrate; then he would, with a graceful gesture, turn and suddenly fall on the left knee, immediately in front of the gayly decorated altar, with his back to the altar, he facing the east, and, throwing his head back, run the sword down his throat, leaving nothing but the handle to be seen. This feat was repeated three times, when the eagle-plumes were again dipped into the medicine-water, and touched to the mouth. To convince myself the knife was genuinely put down the throat, after long persuasion, I induced a youth belonging to the order to swallow the knife. This was done in secrecy. The youth removed his head-kerchief, and took off his leather belt and pouch, and, after repeating a long prayer, he placed the knife in his mouth, running it down the throat to the handle. I am told death is sometimes the result, but this is always attributed to a bad heart."

In closing, Mrs. Stevenson said, "The brief account which has been given of the medicine orders of the Zuñi is perhaps sufficient to convey an understanding of this interesting phase of the pueblo life of North America. The dignitary, who is usually called the 'medicine-man' among our Indian tribes, is something more than the term implies in civilization. The medicine-man is both priest and doctor, and, by reason of his priestly office, he sometimes becomes a judge. The mythical beings with whom he holds converse are the gods of his people. They are the persons who bring evils, or preserve from evils: they bring health or disease, they bring peace or war, and they bring plenty or want at harvest time. Thus in all respects the gods are supposed to hold within their power all prosperity and all adversity. So the priests stand between the people and these gods, and by means of ceremonies, incantations, and many prescribed observances, the gods are induced to preserve from evil and bring happiness. The medicine practices of the Zuñi are therefore religious observances and rites; and the daily life of the Zuñi, under the guidance of their priests through the agency of the medicine order, is so controlled that every act of life assumes something of a religious character. To them their religion is fraught with much fear; to them it brings many trials, many privations, and much suffering. Notwithstanding this, they derive from it much amusement and great joy, and in it all their hopes and aspirations are centred."

Early Stages in the Life of Taenia Pectinata.

Thousands of sheep and lambs perish every winter on the ranches west of the Missouri River. They are not apparently afflicted with any disease. They are weak and lean in the fall, and simply seem to be unable to withstand the severity of the blizzards. The Bureau of Animal Industry, of the Agricultural Department, has been engaged in an investigation to ascertain, if possible, the cause of the weakness of the animals that perish, and Mr. Cooper Curtice visited the West in the prosecution of this work. An examination of the viscera of slaughtered sheep and lambs, fat and healthy ones as well as those that were weak and lean, disclosed the fact that they were almost without exception infected with tape-worms, which were found in the duodenum and gall-duct. In the latter they were frequently so numerous as to close it up, and cause a suspension of its functions.

For the purpose of continuing his studies, Mr. Curtice brought from the West a number of lambs, which were killed at intervals and their viscera examined; and this material having been exhausted, and it being inconvenient and expensive to obtain more, he turned his attention during the past winter to a study of the early stages in the life of the *Taenia pectinata* (common unarmed tape-worms of the rabbit). In studying these, Mr. Curtice thinks that he has made some interesting discoveries, which he presented to the Biological Society of Washington at a recent meeting.

The variety examined is found abundantly in nearly all rabbits in this locality. The life-history of the armed tape-worms of man and dogs has long been written; but that of the unarmed species inhabiting our domestic animals, especially cattle and sheep, is as yet comparatively unknown. As far as has been ascertained, the life-history of the *Taenia pectinata* is embraced in two stages. The first covers the development of the ova into the embryo, which is ready to leave the parent *Taenia:* the other covers the period of growth from the youngest forms yet found in rabbits to the adult stage. The life of the *Taenia* from the time they leave the first rabbit as an embryo, until they are found as young *Taenia* in the second rabbit infected, has as yet been unascertained. Among the theories that have been advanced, is one that they pass this stage upon the ground, are eaten by insects, snails, or crustaceans, and that these are then eaten by the rabbits. This, however, is only a theory, as none have ever been found in snails, insects, or crustaceans.

It was Mr. Curtice's good fortune to find a rabbit which had recently been infected with these peculiar parasites, none of which were over three centimetres in length, many of them being less than five millimetres long. There were more *Taenia* in that rabbit than any he had ever seen before, — about eighty-five. Among the smaller *Taenia* were several specimens that showed the stages of development from non-segmented, armed forms, to segmented, unarmed forms. Mr. Curtice showed to the society specimens illustrating the different stages.

The youngest forms detected were not the smallest, but measured about one-half a centimetre in length. They contained, in addition to the four suckers, a cup-shaped cavity in the place of the rostellum. Around the border of this cup-shaped cavity were situated eighty-five or ninety hooks. The older specimens show a similar cavity, with no hooks. Still older ones show no cavity at all. All of these were in the non-segmented stages; but other forms, some of them smaller, were without signs of hooks, and had already begun segmentation.

Mr. Curtice compared these stages with similar stages in *Taenia serata*, and said that the youngest stage of the *Taenia pectinata* was probably a cysticercoid stage, and not the cysticercal, and that this was indicated by the cup-shaped cavity in the youngest forms of the *Taenia pectinata*.

In discussing the classification founded on the presence or absence of hooks, he declared it to be incorrect, since the discovery described above shows that the unarmed species in adult stages are armed in earlier stages.

The speaker exhibited some elegant drawings made by Dr. George Marx, illustrating the embryo as it leaves the parent *Taenia*. This embryo is six-hooked, and surrounded by a curious pyriform envelope, to which there is a double prolongation surmounted by a cap of the same substance. The cap has a shredded border, and is believed to be the remnants of a mass which, in an earlier stage, completely surrounded the embryo. This peculiar envelope has been previously noticed in Italy by Perroucito, and in France by Raillet. This stage is similar to that found in *Taenia expansa*, the unarmed tape-worm in sheep.

Implanting Teeth.

Dr. Yonger of San Francisco was the first dentist in this country to perform successfully the experiment of implanting teeth. This process is not to be confounded with transplanting teeth, which has been practised by dentists for many years. In the latter operation, a tooth freshly extracted is inserted in a socket from which one has just been drawn, and the parts unite, circulation between the jaw and the tooth is established, and the latter actually takes the place of its predecessor.

In Dr. Yonger's experiment, the tooth to be replaced has long been extracted, and the socket filled up with bony substance. He drills into the jaw, gouges out a new socket, and then, taking a tooth that has long been extracted, cleans it thoroughly, soaks it in bichloride of mercury, and inserts it in the socket just formed. This new tooth in due time becomes firmly anchored, and as serviceable as the original one before it became decayed. Dr. Yonger holds that the tooth is held in its place by the soft tissues surrounding it, and that the artificial socket has nothing to do with anchoring it.

The experiment described above was performed by Dr. G. M. Curtis of Syracuse, N.Y., who afterward extracted the implanted tooth, and sent it to Dr. W. M. Gray, the microscopist of the surgeon-general's office, who has made a very careful examination of it. His experiments prove beyond question that the tooth so implanted is revived, that circulation is established between the socket and the implanted tooth, and that the socket does take an active part in anchoring the tooth. A tooth so implanted is much more firmly anchored in the jaw than one of the originals, and, in the case referred to, the tooth was held so firmly that Dr. Curtis broke it in extracting it. Dr. Gray does not doubt that the soft tissues do take an active part in the operation, but he has proved his propositions in regard to the bone and the tooth beyond all question.

Some Recent Discussions of Target-Shooting.

At the last meeting of the Mathematical Section of the Philosophical Society, Mr. Charles H. Kummell read some remarks on some recent discussions of target-shooting. In opening, he briefly reviewed a previous communication on the same subject which he had made in 1883, stating as the fundamental assumption (there credited to Liagre, but due apparently to Poisson), that the deviations of the shots from a vertical axis, called sighting errors, and those from a horizontal axis, called levelling errors (each axis passing through the centre of the target), each independently follows the exponential law of error. One of the most important consequences of this assumption is, errors of shooting of equal probability are on the circumference of an ellipse whose axes are in the ratio of the mean sighting and levelling errors. Among the writers on the same subject, Mr. DeForrest, in the Transactions of the Connecticut Academy, vol. vii. 1885, requires not only the sighting and levelling axis, but even the centre of the target, to be ignored, and a new centre and system of free axes determined from the distribution of the shots on the given target. Mr. Kummell thinks this method of discussion quite proper, if we really were ignorant of the true position of centre and axes. But, such not being the case, a merely probable thing should not be preferred to a fact.

In the January number of *Comptes Rendus*, 1888, Mr. J. Bertrand objects to the previous methods of discussing target-shooting, on the ground that the levelling and sighting errors are not independent, but admits that in some as yet unknown curve (not an ellipse) would be found shots of equal probability, and proposes to establish one of these curves for any given target by dividing it into a convenient number of sectors, and taking the mean shot in each. Mr. Kummell inquires what this discussion will lead to. It is certainly too rough for a limited number of shots, and whatever curves may be found in any special case, they will be sufficiently near ellipses, as required by Poisson's assumption.

The Drift North of Lake Ontario.

The short paper upon this subject read by Prof. J. W. Spencer before the Philosophical Society at its last meeting was a generalized description of some of the obscure and conflicting phenomena of the drift.

Among the deposits of the later pleistocene period, he said in substance, there is a well stratified, hardened, brown clay charged with pebbles more or less glaciated, resting upon typical blue bowlder clay, north of Toronto. In the Canadian classification of the pleistocene deposits there is no place for this deposit. Indeed, all of the stratified deposits of this region need revision in the light of the progress that has been made in surface geology during the last twenty years. Thus the Saugeen clay is resolvable into three series. The relation of all the clays to the older beaches requires special study, as a part of them probably represent the deep-water deposit of the beach epoch, while some of the later beaches rest upon such clays.

Around the head of Georgian Bay there are ridges in the form of moraines, similar to those about the other Great Lakes, reaching to the height of thirteen hundred to fourteen hundred feet above the sea. From the face of the Niagara escarpment — between Georgian Bay and Lake Ontario — there extends for over a hundred miles, to near Belleville, a broad zone of from eight to twenty miles in width, covered with drift-ridges composed of stony clay below, and frequently stratified clay or sand above, having an elevation of from eleven hundred to twelve hundred feet above the sea, with occasional reductions to nine hundred feet. These 'Oak Hills or Ridges' rise from three hundred to five hundred feet above the flat paleozoic country to the north. The stones in the clay are glaciated, often of limestone, with only a small proportion of crystalline pebbles or bowlders. In the deposits of the ridges, native copper has been found: consequently the drift-carrying agent moved south-eastward down Georgian Bay, to the west end of the Oak Ridge, and probably throughout its whole length. North and east of Belleville there are many more and fragmentary ridges having a trend somewhat across that of the Oak Ridge.

The glaciation of the region adds great difficulties to the explanation of the phenomena. The striation in the Ottawa valley, from Lake Tamiscamang to the junction of the St. Lawrence, is to the south-eastward, with very rare local exceptions. On the Niagara escarpment, between Georgian Bay and Lake Ontario, from sixteen hundred down to seven hundred feet above the sea, the striæ are also to the south-east; but between these widely separated regions the surface markings of the rocks are obscured to the west and south by drift, and to the north and east are absent and rarely seen, although the crystalline rocks are commonly rounded or very rarely polished, — an absence that can only in part be accounted for by subsequent erosion. About the St. Lawrence and Lake Ontario the striations are to the south-west or west. Between the Ottawa River and Georgian Bay there is a high prominence which divided the drift-bearing currents; but north of Lake Huron the glaciation is very strongly marked, and the direction is to the south-west, with very rare local variations.

All the lobes of glaciation about the Lakes, from Superior to the Ottawa valley, radiate backwards to the broad and open, but low basin of James's (Hudson) Bay. The watershed between the Lakes and Hudson Bay, during the epoch of the formation of the drift, was several hundred feet lower than now, — which is about sixteen hundred feet at present, — as shown by the differential elevation of the beaches.

For these conflicting phenomena of the drift no explanation was offered, but rather sought for.

Some remarks upon the paper were offered by Mr. Gilbert, who had observed the slight amount of erosion in the Ottawa valley; but he thought that generalized explanations of the drift were very often contradicted when applied to special regions, and that our knowledge of the phenomena would not at present give a satisfactory explanation.

Determination of Atomic Weights.

Prof. F. W. Clarke, in a paper on the determination of atomic weights, read before the Philosophical Society at its last meeting, discussed the sources of error in such constants, both with regard to the processes of weighing and to the chemical considerations involved. He dwelt especially upon the uncertainty in the atomic weight of oxygen, which affects the atomic weights of nearly all the other elements, and urged the importance of other determinations which should not hinge upon oxygen. Prout's hypothesis, now of importance in all discussions as to the nature of the chemical elements, requires the most precise determination of atomic weights, and none of the latter are yet known with enough certainty to settle the question at issue.

Distribution of Indian Tribes in North America.

The United States Geological Survey has nearly ready for publication a map showing the distribution of the Indian tribes on this continent north of Mexico. Including the labor which Major Powell himself and his immediate assistants have expended in the collection, arrangement, and digestion of the material for this map, and that done by the Bureau of Ethnology, it will represent the work of about fifteen years, and will be one of the most important and interesting publications ever made by the Geological Survey. All of the Indians living in this country at the time of the white occupation have been divided into linguistic families, and the territory occupied by each one of these families is represented on the map by a distinctive color. The number of these families is about 60, and the number of separate tribes between 300 and 350.

One of the first and most important facts shown by this map is that the territory occupied by each linguistic family, with few exceptions, is continuous. An important deduction in relation to the habits of the Indians is drawn from this fact, — that instead of being nomadic, and wandering over the continent at will, as has been generally supposed, the Indians had fixed homes, the boundaries of which were almost as plainly marked as the dividing lines between the several States are to-day, and that their wanderings were within limited areas, rarely or never extending beyond these fixed boundaries. The Indians had their permanent villages, in which they lived for five, ten, twenty, or perhaps fifty years. At certain seasons of the year they went to the coast or to the rivers to fish, or to the forest or plains to hunt. The boundaries of the territories occupied by each family were occasionally changed by conquest. A stronger tribe or family would by war push back its weaker neighbors, and thus extend its dominion. But the territory so conquered was recognized by the vanquished, as well as by the victor, as the property of the latter. If the Indians had been nomadic, and wandered over the continent or over large portions of it, branches of the same linguistic family would have been found scattered broadcast all over the country.

Some of the few exceptions to this general rule of distribution are exceedingly interesting, and throw a light upon the unwritten and even forgotten history of some of the tribes. For instance: a little colony of the great Siouan family is found in Virginia. How it became separated, crossed the mountains, and maintained itself in the midst of another family speaking an entirely different language, suggests a very interesting topic for the study of the ethnologist. Again: all the north-western part of the continent was occupied by the Athabascan family, very peaceable Indians. But the Apaches and Navajos of New Mexico and Arizona belong to the same family, and are among the most warlike on the continent. To their surroundings and the necessity of wresting their new home from its previous occupants and holding it, as well as to the inhospitable character of the country, may not their change of character be attributed? Another little tribe of the Athabascans is found in California.

One of the most degraded families of Indians of North America is the Shoshonean, of which the Diggers are a branch. And yet, strange as it may appear, the Moquis, more advanced toward civilization than any others of the Pueblo Indians, are Shoshonean.

One exceedingly interesting feature of the map is the great number of little families that lived in California and Oregon. Some of these comprise only a few individuals, — not more than forty or fifty, — and yet their languages are entirely distinct from those spoken by the surrounding tribes. In one instance Mr. Henshaw, who has charge of the construction of the map, found in California a single man, the sole survivor of his tribe. From him enough was learned to preserve the language once spoken by his ancestors, but with his death that tongue becomes extinct.

A very curious fact in relation to the distribution of the Eskimo is that they inhabit the coast of the Arctic regions to the exclusion of other Indians, beginning on the east shore of Greenland, and following the coast-line of that island around to the point farthest north inhabited by man. Then, beginning on the coast on the mainland, they occupy narrow strips on the north shores of Hudson Bay and along the northern coast of the continent, around past Bering Strait, and down the north-west coast of the continent to Prince William's Sound. Throughout all this immense coast-line the differentiation of language is very small; so that an Eskimo from Greenland transported to Bering Strait would in a month be able to speak the language of the natives there as well as though he had been born there. In striking contrast were the numerous distinct families of Indians in the valleys of California and Oregon, whose languages are so different that they could not understand each other.

This map, when published, will be accompanied by a report and discussion of the facts it discloses, and will be a very important contribution to the science of ethnology.

HEALTH MATTERS.

Malaria.

THE subject of malaria has always been a most interesting one for the study of the physician. Until the year 1879 its origin was obscure, although various theories were advanced to account for it. Klebs and Tommasi-Crudeli, in 1879, discovered in the soil of the Roman Campagna a bacillus, to which they gave the name *bacillus malariæ*, and to which they attributed malarial disease. In 1881 Laveran, a French surgeon in Algiers, discovered the *plasmodium malariæ*, which he found in the blood of patients suffering from malaria. The views of Laveran are to-day the most generally accepted. Councilman, Osler, and Sternberg, all American physicians, have given much attention to the subject, and, so far as we know, have in general accepted Laveran's views. Dr. M. B. James of New York recently read a paper on this subject before the New York Pathological Society, which is published in the *New York Medical Record*. He says that at present our knowledge may be summed up as follows: —

"In the blood of persons suffering from malarial disease there is a series of phenomena not yet found under any other conditions. These phenomena point to the presence of an animal parasite. The appearances that we get are one or more of the following:

"*First*, Colorless protoplasmic bodies inside the red blood-corpuscles. They vary in size from one-fifth to almost the whole diameter of the corpuscle. They exhibit active amœboid movements. Some contain scattered granules of brownish-black pigment; others are unpigmented. The red corpuscle which contains the amœboid body is commonly larger, flatter, and paler than normal.

"*Second*, We find disk-shaped bodies of colorless protoplasm. They are somewhat larger than a red blood-corpuscle. They show no amœboid movements. They contain scattered pigment-granules. They are apparently a later stage of the form first mentioned, which has come to occupy the entire corpuscle, and has then entered upon a cyst stage.

"*Third*, We find forms similar to the cysts, but in which the pigment-granules have become massed at the centre, while the protoplasm is undergoing segmentation. Then there are found various stages in the transition from the encysted to the segmentary form.

"*Fourth*, We have the small masses of protoplasm that have resulted from the segmentation of the cyst form. They are commonly somewhat oval in shape. In fresh blood it is difficult or impossible to distinguish them from blood-plaques. In dried blood they show a tolerably characteristic bipolar staining with aniline dyes.

"*Fifth*, We have hyaline bodies of crescentic shape, in length rather more than the diameter of a red blood-cell. They have, in every case, a collection of pigment-granules in their centre. These are the so-called 'crescentic bodies.'

"In some cases there are found bodies resembling the crescents closely in character, but elliptical or round. The crescents may have a delicate curved outline opposite the concavity or convexity, or both, but this outline never reaches quite to the tips of the crescent.

"Lastly, there are the various motile bodies. These are, first, flagellated bodies, — a round or pear-shaped body, about one-half the diameter of a red blood-cell. It contains pigment-granules, and is provided with from one to four flagella, which show an active lashing motion, and by means of which the organism moves about in the blood-plasma. The flagella are several times as long as the diameter of a red cell. Their motion is active enough to set up well-marked movements on the part of the neighboring blood-corpuscles. Second, free flagella have been described. They seem to have become detached from their bodies, and to be capable of leading an independent existence. They exhibit active movements. Third, some observers have described hyaline pigmented bodies with an actively moving, undulating periphery."

In thirty-five cases in which Dr. James had an opportunity of studying the blood, he found the parasite in thirty-four. In one case, in which he was able to examine the blood but once, he failed to find it. In several cases where the diagnosis was doubtful he has been able to exclude malaria by failing to find the plasmodium, and the subsequent history has confirmed the microscopic examination.

The microscopic technique is simple. The blood is best examined fresh, spread out in the thinnest possible layer, — the rouleaux of corpuscles broken up. High-power objectives are necessary. A $\frac{1}{12}$-inch oil immersion answers well.

Stained specimens are best prepared by drying the blood in a very thin layer on a cover-glass, which is then passed through a flame, as in examining for bacteria. It may be stained in a watery solution of an aniline dye, washed out in water, or partly decolorized in alcohol, and mounted, as usual, in balsam. Fuchsine and methylene blue give the best results. Dr. James finds methylene blue most satisfactory, the red corpuscles staining light green, and the hæmatozoa blue.

Unpigmented amœboid bodies are best studied in stained specimens. The pigmented amœboid bodies, which are those most commonly met with, are best seen in fresh blood. The crescents also show most satisfactorily unstained. The segmenting bodies and free spores are best studied after drying and staining.

The apparent effect of medication on the organism is important. A few large doses of quinine are almost invariably followed by a disappearance from the blood of the various amœboid forms. The crescentic bodies remain unchanged after quinine, but commonly show a diminution in number as the health improves under the treatment proper for chronic paludism.

These apparent results of treatment followed in his cases as in those of most other observers. The organism has not yet been discovered except in human blood and organs. It has never been isolated. It has never been cultivated outside the body.

Inoculative experiments on human beings are almost uniformly successful. Intravenous injection of malarial blood into a healthy individual is followed by typical intermittent fever, with the appearance in the blood of the second person of the various forms of the organism described. These experiments have been made by Gerhardt in Germany, and by Marchiafava and Celli and other Italians.

Subcutaneous injections have been unsuccessful.

The few inoculative experiments that have been made upon monkeys have been unsuccessful.

As regards the name of the organism: the term 'plasmodium' has been improperly used in this connection. This name has long been applied to a segregation stage of some of the mycetozoa, and so means, not a particular organism, but a stage of development common to many different organisms. Moreover, so far as we know, the malarial germ has no plasmodium stage.

It is much better, then, in designating the malarial organism, to use the term 'hæmatozoon of malaria,' as suggested by Laveran, which commits us to no definite classification.

Typhoid Infection. — The investigation into the outbreak of typhoid-fever at the Michigan State Prison at Jackson by Prof. V. C. Vaughan has resulted in obtaining facts which tend strongly to prove that the outbreak was due to defective sewerage. We have repeatedly maintained in *Science* the probability that sewers and house-draining were efficient agents in the propagation of typhoid-fever, basing our opinion upon a large number of cases which occurred in Brooklyn in 1885, in which all other sources seemed to be excluded. In the investigation which Professor Vaughan made, the water-supply and milk-supply were first ruled out as possible vehicles by negative evidence. It was then thought that the defective condition of the sewers, combined with the insufficient supply of fresh air, was the most probable cause of the epidemic. The cases nearly all were from a distinct portion of the prison, and investigation proved that the soil-pipe running from the hospital, and the house-drain, into which it entered, were defective, and were pouring sewer-air into that portion of the prison. Professor Vaughan took to his laboratory a sample of the air from within the soil-pipe, and has found within it the specific germ of typhoid-fever. Such facts as these are of the greatest practical importance, and should be made a matter of record whenever they are observed, and should be widely disseminated. They show the absolute necessity for thorough disinfection of the excreta of typhoid-fever patients, and the dangers which may and probably will result from a neglect of this important measure. Had the discharges from a single typhoid-fever patient been efficiently disinfected, the devastating Plymouth epidemic, which resulted in the sickness of 1,153 persons, and the death of 114, and a total money-loss of $115,539, would never have occurred.

Grafts on Wounds. — Dr. Redard has communicated to the Académie de Médecine of Paris, according to the *New York Medical Record*, some observations regarding animal grafts on wounds in human beings. In a case of severe burn of the scalp, of eight months' standing, in a child two years of age, he obtained a rapid cicatrization by means of grafts from a fowl. He first tried grafts of frogs' skin, but as these proved to be repulsive to patients, and did not give very good results, he substituted others from the fowl; and the wound, which measured three inches by two and a half, had completely healed in two months. He had been equally successful in other and subsequent cases. He takes the skin from beneath the wing of a chicken, carefully securing the subjacent cellular tissue, but avoiding adipose tissue. The transplanted pieces varied from a sixth to a third of an inch in size, and they were maintained in position by means of a little cotton-wool and iodoform gauze. The skin of birds and fowls has the advantage of being supple, delicate, and vascular: it adapts itself readily to the surface of the wound, and adheres without undergoing absorption.

THE HUMAN BREATH. — Professor Brown-Séquard has recently been making experiments to determine whether the human breath was capable of producing any poisonous effects. From the condensed watery vapor of the expired air, he obtained a poisonous liquid, which, when injected under the skin of rabbits, produced almost immediate death. He ascertained that this poison was an alkaloid, and not a microbe. The rabbits thus injected died without convulsions, the heart and large blood-vessels being engorged with blood. Brown-Séquard considers it fully proved that the expired air, both of man and animals, contains a volatile poisonous principle which is much more deleterious than carbonic acid.

ELECTRICAL SCIENCE.

Electrical Traction.

IN the last two or three years a number of street-car lines have been equipped with electric motors, and most of them have been successful in spite of the inexperience of those who have done the work, — an inexperience due to the newness of the field. The number of electric railroads under way is increasing rapidly, and for certain classes of work the motor seems destined to take the place of the expensive and overworked car-horse.

As yet the greater part of the lines equipped have been for city tramways, generally in the suburbs, where there is comparatively little street traffic. This, however, is only a beginning, more useful in the experience it gives, and in the problems that are brought up and solved, than in the absolute results: for the question of the application of electricity to traction is a very broad one, and does not stop at street-railways. The elevated railroads may be run by electric motors; already motor cars are used in mines, where there is an extended field for their use; and it is possible that a few years will displace the steam locomotive, and substitute in its place powerful electrical locomotives.

There is no apparatus for the transformation of energy that compares in simplicity and efficiency with the dynamo-electric machine and electric motor. The steam-engine transforms perhaps fifteen per cent of the energy of coal into mechanical work; while the efficiency of a good dynamo may be ninety-two per cent, and a motor may have as high an efficiency. If, therefore, we transform mechanical work into electrical energy by a dynamo, and retransform it to mechanical work again by a motor, we have a total loss of perhaps fifteen per cent. It may be easily shown that in many cases it would be profitable, by taking advantage of the higher efficiency of large-power plants, and the comparatively small cost of attendance, repairs, etc., per horse-power, to generate all the mechanical energy needed in a district at some central station, and distribute it by dynamos and motors to the consumers, displacing the small steam or gas engine plants previously used.

For traction-work the problem is not to replace stationary steam-engines or gas-engines, but to replace horses, cables, and locomotives. This problem is being attacked, and will doubtless be at least partially solved.

Before taking up the relative merits and cost of different systems, let us consider the broad questions that are involved. The questions are, (1) How can we best produce the electrical energy needed? (2) How can we best get it to our motors? and (3) After we get it there, what is the best way to apply it to traction?

Under the first head there are a good many things to consider, and many of these can only be answered by knowing the exact conditions of our installation. We can say generally that for a given horse-power needed at our motor we should so choose our source of power and location of generating-station that the interest on first cost of plant and conductors (supposing we use them), the total depreciation, and the cost of the power *generated*, should be a minimum.

We will discuss these questions more fully when we come to the question of cost. To show the nature of the problem that might arise, suppose we have a railroad line from Philadelphia to New York to be run by electric motors. We would possibly find it best to have a number of generating-stations along the line, at distances apart of, say, twenty miles. Now, if there were no natural sources of power near the tracks, we would have to calculate the best distances apart for these stations, knowing the cost for a horse-power with plants of different sizes, the cost of copper for conductors, the cost of a ton of coal at different points on the line, etc. The problem would not be a difficult one. If, however, there was at some distance from the line a source of natural power, — a waterfall, for example, — we would have to redistribute our stations, and calculate whether it would cost less or more to utilize the waterfall, decreasing the cost of power, in that we do not have to pay for coal, but increasing the size of plant for a given electrical energy at the line (for we must supply the needed energy *plus* the loss on our lines), and increasing the outlay in conductors. Of course, this is all a very definite question, presenting little difficulty to the electrical economist. When we consider that some railroad lines have distributed near them water-power capable of running all of their trains, with help at long intervals from steam-generating stations (even windmills are not to be despised in some cases), and when we further consider that the conditions are much simpler than in city traffic (we can use high potentials and unsightly devices if we choose), it encourages one to predict a future for electric railroads.

If, as I have so far assumed, we are going to transmit the electrical energy to the motors by conductors, it is evident that the potential we can use comes in as a factor. In cities we are usually limited to a comparatively low potential, — a maximum, say, of five hundred volts. This has the effect of locating our generating-station as near the line as possible, — in the middle of the line if we can get it there, — for the cost of conductors would be great if the station were too far from the line. We will have more to say on this in any early number.

ELECTRICAL TREATMENT OF SEWAGE. — Mr. William Webster, F.C.S., has patented a process of purifying sewage by means of the electrical current. The pollution of rivers by the sewage of large cities is a constant source of danger to health; and, according to the London *Standard*, £1,000,000 is to be spent in attempting, by the employment of chemicals, to purify the London sewage. Mr. Webster's plan consists in sending a current of electricity from metallic electrodes through the sewage. The result, in experiments made on a very small scale, is to set the solid particles held in suspension in motion, "a kind of procession taking place from the top downwards, and from the bottom upwards. The sum-total of the movements consists in landing the suspended particles at the top of the liquid." "So prompt is the effect of the electric current that in twenty minutes a volume of opaque sewage becomes perfectly transparent, except at the top, where the organic matter collects in a semi-solid form." "From results already obtained it is calculated that the cost of the electrical treatment of the London sewage would be about £25,000 per annum. The annual outlay for chemicals is expected to be £18,000 for lime and iron, and £12,000 for permanganic acid, making a total of £30,000, a balance of £5,000 in favor of the electrical method. It would seem that Mr. Webster's experiments have, as yet, been on a small scale. If the practical results bear out what has been done in the laboratory, the process will be of the greatest importance.

TRANSFORMERS. — Two papers on this subject, read before the Society of Telegraph Engineers and Electricians, — one by Mr. Kapp, the other by Mr. Mackenzie, — have excited considerable discussion and interest on this subject of commercial induction-coils. Mr. Kapp's paper treats of the relative merits of different forms of transformers, and his methods are simple and easy of comprehension. In all of this work on alternating-current apparatus the assumption that the electro-motive force and the currents follow simple sine curves is made; and, while the error in the assumption may or may not affect conclusions as to the types of action that occur, yet it must vitiate any attempt to deduce absolute values. Up to the present the subject of alternating currents has been singularly barren of experiments, while quite a number of problems have been solved by analytical and graphical methods. It is well known that a great many effects are not taken into account in the ordinary treatment, but the value of these outside effects has not been determined. The full discussion of these papers has not reached this side of the ocean: what has reached us is interesting and important, and will be given when the rest of it arrives.

BOOK-REVIEWS.

Chambers's Encyclopædia. New ed. Vol. I. A to Beaufort. Philadelphia, Lippincott. 8°. $3.

THE original issue of this work was completed twenty years ago, and few works of the kind have enjoyed an equal popularity, or rendered better service to the mass of readers. It is, of course, not to be compared in elaborateness with the *Britannica*, the articles in which are often in the form of lengthy treatises; but for non-professional readers, who do not wish to make a special study of the various branches of knowledge, but seek for general information on all subjects that arise in reading and conversation, this work has proved very valuable. The progress of events, however, and the increase of knowledge in almost every branch, have necessitated a new edition, the publication of which has now been begun. Many articles have been rewritten, and others partially so, while all have been subjected to a careful scrutiny by competent hands; and the result, so far as we have examined the work, seems to be excellent. Considerable attention has been given to American subjects, the more important of which have been treated by American writers; and their articles have been copyrighted in the United States by the J. B. Lippincott Company of Philadelphia, who publish the encyclopædia in this country. There is an article, however, on Americanisms in language, by an Englishman, Mr. Grant Allen, which contains some great mistakes. Thus, he says that "the speech and writing of the uncultivated classes diverge increasingly from the pure literary English standard;" the fact being that the language of the uncultivated Americans tends increasingly towards the literary standard, owing to the influence of the public schools and the growing taste for good reading. But most of the articles on American subjects are very good. One of the most difficult tasks in preparing an encyclopædia is to allot the right proportion of space to the various subjects treated, and in this respect the editors of this work have been quite successful. If the remaining volumes are up to the standard of the first, the encyclopædia will deserve and receive a renewal of the favor it has hitherto enjoyed.

Familiar Animals and their Wild Kindred. By JOHN MONTEITH. Cincinnati and New York, Van Antwerp, Bragg, & Co. 16°.

THE idea of presenting school-readers for youthful scholars, treating of familiar topics in natural science, is not a new one, but it is a thoroughly good one. The writer well remembers the permanent interest in every thing pertaining to natural history engendered in him by the use of the Wilson series of readers in years gone by. Such reading-exercises have been improved since that time, however, though there is still room for improvement. In no way, in the hands of a good teacher, can a child's powers and aptitude for self-observation be better stimulated than by well-prepared reading-exercises treating of the familiar forms of life. The knowledge imparted in such exercises should be accurate and comprehensible, but scarcely less important is the manner in which it is presented. A description that leaves nothing for the child himself to find out, no conclusions for him to draw, is of but secondary value. His faculties for thinking and observing, not his memory, need the most training.

The present school-reader, for that is what it is, meets fairly well these requirements, and, taking it all in all, merits commendation. It is intended for children of the third-reader grade, or say from eight to ten years of age, and is not only interesting, but instructive to them. The habits and anecdotes of the domestic and other familiar animals and their wild kindred are presented in pleasing shape. The material is largely adapted from known writers, or drawn from such authorities as Mivart, and is reliable. The engravings are good. Only mammals are treated of, and nowhere is the erroneous impression corrected that the word 'animals' is synonymous with four-footed mammals.

A Catalogue of Canadian Birds, with Notes on the Distribution of Species. By MONTAGUE CHAMBERLAIN. St. John, J. & A. McMillan. 12°.

THIS is an annotated list of the birds hitherto recorded or observed as residents or visitants of the vast and ill-explored region north of the United States. It is in reality the first attempt of the kind, and can only be looked upon as preliminary; but, though only a preliminary list, it has required labor, and will be very useful for future workers in Canadian ornithology, — a branch which, when we consider the excellent work done by the Canadian entomologists and botanists, has been much neglected in the Dominion. Notwithstanding the future revision which this list must be subject to, the author might have added to its value by tabulations after the manner of Merriam's work. By counting, it is ascertained that the whole number of species and sub-species recorded is nearly five hundred and fifty.

The Story of Creation, a Plain Account of Evolution. By EDWARD CLODD. London and New York, Longmans, Green, & Co. 12°. $1.75.

OF book-making on evolution there is yet no end. The present little work, however, presents a claim for recognition, not as an exponent of new views, theories, or facts, — for, as the author very naïvely admits, there is probably not a new idea in it, — but rather as an elementary exposition, a text-book, of the subject. As such, it will hardly find a place on the shelves of either the professed physicist or biologist, save as a fairly good epitome of the materials and methods of evolution in its widest sense. But to him or her who would not decry or accept Darwinism without some knowledge of the subject, and that fashion is happily subsiding, the work can be heartily commended. The author, while treating his subject in a scientific manner, has endeavored to make his book popularly readable; and he has succeeded fairly well, though the compression of so vast a subject into one small volume could hardly fail to produce a text-book-like concentration that will deter the mental dyspeptic. More than half the volume is made up of descriptive matter, both physical and biological, of the earth and the universe: the remainder is explanatory of their development or evolution, including man psychologically. In other words, as already stated, the author strives to give a brief exposition of the materials and methods of evolution in its widest sense. There are numerous good engravings, and the statements of fact, at least on the biological side, are in general fresh and reliable. The author might very properly modify the paleontological fiction of the thirty by one hundred foot Jurassic monster. It has never existed, for aught that is known, save in the describer's imagination: the figures need reduction one-half.

Practical Physics for Schools. Vol. I. Electricity and Magnetism. By B. STEWART and W. W. H. GEE. New York, Macmillan. 16°. 60 cents.

MOST physicists and many teachers of physics are already familiar with the two volumes on 'Elementary Practical Physics' by Messrs. Stewart and Gee, and nearly all will agree that they constitute an extremely valuable contribution to the facilities now available for the successful prosecution of instruction in physics by laboratory methods. The small volume now under consideration, since the word 'elementary' is omitted from its title, might be assumed to be more pretentious in its plan and execution than the others.

The contrary is the case, however, as it is intended for a lower grade of work. It is, as the titlepage has it, "for schools and the junior students of colleges."

To a considerable extent the book is an abstract, with simplifications, of the second volume of the other series. It is not entirely so, however, as there are numerous additions, and, what is most notable, the plan of the work in one particular differs radically from that of the larger and more complete volume. The original series from which this is derived is intended to serve as a laboratory guide, and must be used in connection with some good text-book. The present volume is so written as to be available as both a text and a laboratory book, but it will probably be found more useful as a working handbook, and as an adjunct to a well-prepared text. The explanations of principles are invariably good, but not always sufficient, the necessities of the case requiring a degree of condensation sometimes incompatible with great simplicity. In common with the other members of the family to which it belongs, the book has great merit. In the beginning there is an introductory chapter on fundamental measurements and measuring instruments; there is next an excellent chapter on electrostatics, but which will appear to be somewhat long to some American teachers whose ambition seems to be to reach the dynamo-machine in the shortest possible time; then follows a chapter on magnetism; and the remainder of the book is devoted to voltaic electricity, electrical instruments, and measurements. There is an appendix, which, besides some additional practical hints to teacher and pupil, furnishes a price-list of instruments and materials needed for the laboratory and laboratory workshop, and complete plans, drawn to scale, of three recently established school laboratories. These will be of great service to those contemplating such additions to their school equipment; and the book, as a whole, can be strongly recommended to all interested in the advancement of elementary instruction in physics.

Among a few defects of minor importance may be mentioned the strict adherence, peculiar to English authors, to the concave mirror and scale for galvanometer and other purposes, omitting the consideration of the plane mirror and telescope method, which is often much better and much more available than the other. Taken in connection with the other series by the same authors, the title of this volume is unfortunate, and likely to lead to considerable confusion in making orders, references, or quotations.

The New Astronomy. By SAMUEL PIERPONT LANGLEY. Boston, Ticknor. 8°.

"I HAVE written these pages, not for the professional reader, but with the hope of reaching a part of that educated public on whose support he is so often dependent for the means of extending the boundaries of knowledge.

"It is not generally understood that among us not only the support of the government, but with scarcely an exception every new private benefaction, is devoted to 'the Old' Astronomy, which is relatively munificently endowed already; while that which I have here called 'the New,' so fruitful in results of interest and importance, struggles almost unaided.

"We are all glad to know that Urania, who was in the beginning but a poor Chaldean shepherdess, has long since become well-to-do, and dwells now in state. It is far less known than it should be, that she has a younger sister now among us, bearing every mark of her celestial birth, but all unendowed and portionless. It is for the reader's interest in the latter that this book is a plea."

The purpose of Professor Langley's book, as well as the charming style in which it is written, are so well set forth in his brief preface, that we have quoted it entire, as above. Supplemented with the clear statement of the opening pages, that the prime object of the old astronomy has been to tell us *where* the heavenly bodies are, while the new endeavors to tell us *what* they are, the reader has at once a clear idea of the scope and aim of this most interesting book. Though not written for the professional astronomer, none such can read it without interest and profit, even if for nothing more than as an excellent example of how to present his hard facts in a pleasing and attractive dress; while every intelligent reader will be pleased not only with the manner of presentation, but with the matter presented; and so plain and easy is the pathway made, that the unprofessional reader has little idea of the months and years of patient investigation — much of it the author's own — which have made these plain and easy statements possible. Rarely, too, or rather never before in an astronomical work, have engraver and publisher so happily united in giving a literary gem so beautiful an artistic setting. The first chapter especially, on 'Sun-Spots,' is rich in beautiful drawings from the author's own pencil while at Allegheny; and those who recall the wonderful frontispiece of Professor Young's excellent work, 'The Sun,' will desire to feast the eye upon the large number of equally fine drawings in the present work. Printed at the University Press of John Wilson & Son, Cambridge, Mass., and upon paper so heavy that the only drawback is the reader's constant fear that he has turned three or four leaves at once, the whole is a beautiful specimen of the bookmaker's art, and a gem which every educated man should possess.

We can only notice in the briefest way the contents of the eight chapters of the book. The first four are given up to the Sun (and after reading them we think the reader will join with us in a request to the compositor to set this with a capital *S*). Chapter I., under the title of 'Spots on the Sun,' treats of the photosphere, and contains reproductions of those beautiful drawings by the author which we have already mentioned. The second chapter, treating of the chromosphere and corona, naturally draws largely upon government eclipse-reports for its illustrations. While many of the latter cannot lay claim to much artistic excellence, they are useful as illustrating very forcibly the difficulties attending the ordinary attempts to sketch the corona during the two or three minutes of a total eclipse, and the need that photography should supplant most of these except for the telescopic detail of the inner corona, which is too fine for the photographic plate, and for the extreme outer limits, for which the eye is much more sensitive. The interesting drawings of hydrogen-clouds and outbursts above the sun's photosphere are naturally nearly all from the works of Young and Tacchini, who have done so much in this field. Right here, in connection with all the illustrations of the book, we would heartily commend the pains taken to indicate the original author or source of every illustration used, either directly under it or in the text close by. This is a matter in which some careless or unscrupulous authors and editors need a sharp lesson.

Chapters III. and IV. are devoted to the sun's energy, and are the most interesting and instructive in the book. Space will not here allow us to note the exceeding number of interesting features dealt with, and we imagine that the author must have felt overwhelmed in trying to deal at all fully, even in forty-seven pages, with the wealth of important phenomena resulting from the outflow of solar energy. We cannot refrain, however, from noting the author's striking experiment of comparing solar radiation directly with the 'pour' of molten steel from a Bessemer 'converter,' — our hottest known source of artificial radiations on a large scale. The result showed that the solar surface, even after being dimmed by absorption in its own and the terrestrial atmospheres, gave out, foot for foot, at least eighty-seven times as much heat as the surface of molten steel, and was more than five thousand times as bright.

In speaking of the exhaustion of the coal-fields, our source of power, the author gives a striking picture of the fair green England of three hundred years ago as compared with its present smoky skies and soot-blackened surface, where the whole island throbs with the coal-driven engine, and the waters are churned by the swift steamer; and then, in the *rôle* of prophet, he unfolds the future of a few hundred years, when almost certainly the 'all-beholding sun' will send his beams "through rents in the ivy-grown walls of deserted factories, upon silent engines brown with rust, while the mill-hand has gone to other lands, the rivers are clean again, the harbors show only white sails, and England's 'black country' is green once more! To America, too, such a time may come, though at a greatly longer distance." And the fourth chapter closes with the following striking paragraph: —

"Future ages may see the seat of empire transferred to regions of the earth now barren and desolated under intense solar heat, — countries which, for that very cause, will not improbably become the seat of mechanical and thence of political power. Whoever finds the way to make industrially useful the vast sun-power now wasted on the deserts of North Africa or the shores of the Red Sea will effect a greater change in men's affairs than any conqueror in history has done; for he will once more people those waste places with the life that swarmed there in the best days of Carthage and of old Egypt, but under another civilization, where man no longer shall worship the sun as a god, but shall have learned to make it his servant."

The four remaining chapters are devoted to the planets and the moon, meteors, comets, and the stars. All equally interesting with the opening chapters, they deserve equal mention, but space forbids. Suffice it to say that they bring our information of new discoveries in these interesting fields up to date; some beautiful reproductions of the photographs of stellar spectra, taken at the Harvard College Observatory, being among the latest important additions to our knowledge of stellar constitution.

In conclusion, we hope that this excellent work of Professor Langley may go far towards its avowed object in arousing an interest in the new, not *versus*, but to an equal degree of importance with, the old astronomy. There can be no question that it is of as much importance to mankind to-day to know *what* the heavenly bodies are, as *where* they are; and the endowments to obtain men and apparatus (the former more scarce, and the latter more complicated and perhaps expensive) with which to answer the first question should be forthcoming. In the report, some years ago, of the National Academy of Sciences, upon the importance of moving the National Observatory to a new site, the establishment of a physical observatory under government auspices was recommended. This is directly in the line of the purpose of this book, and we trust that the latter may be one of the active factors in bringing into being, under government auspices, an observatory wherein the spectroscope, bolometer and galvanometer, polariscope, and photometer, with the rapid photographic plate as the adjunct of all, may stand on an equally important footing with the meridian-circle and the equatorial with only filar-micrometer attached.

NOTES AND NEWS.

THE latest results of the work of Prof. Josiah P. Cooke and Mr. T. W. Richards give as the atomic weight of oxygen, 15.869 ± 0.0017. This is from a paper presented at the American Academy of Arts and Sciences March 14.

— Hartleben's great atlas, 'Die Erde in Karten und Bildern,' is now well advanced. So far, twenty numbers have been issued. The maps are good lithographs, clearly drawn, well lettered, and not overcrowded with names. They serve admirably the purpose of the general reader. The accompanying text is profusely illustrated, and contains numerous views, costumes, etc. The physical geography is now complete, and is followed by a succinct geography of Europe. The price of the whole atlas is only $14.75.

— In *Science* of March 9, p. 121, 1st column, 29th line from bottom, for '90 mm.' read '65 mm.'

— In *Science* of Feb. 24, p. 96, 1st column, last line, for '108' read '118.'

LETTERS TO THE EDITOR.

Unusual Dermal Ossifications.

IN examining the collection of *Testudinata* in the Yale College Museum, I found in specimens of *Testudo Leithii*, Günth., dermal ossifications, which, so far as I am aware, have never been described.

Each fore-limb of this small tortoise is furnished with a well-ossified shield, which covers the anterior and inner part of the limb. This shield is composed of suturally united ossicles, covered by scales, and corresponding in number to the large scales on the fore-arm. Each ossicle is smooth on the inner side, and elevated into an eccentric tubercle on the outer side.

This condition seems important for the explanation of the origin of the carapace and plastron of the *Testudinata*, and supports my view on this point published elsewhere (*Zool. Anzeiger*, Nov. 22, 1886).

There can be no doubt that this peculiar shield of the fore-foot originally consisted of small, free ossicles. Probably different stages of this condition will be found, if these parts are carefully examined in the *Testudinidæ*.

The elemental form of the carapace was, there seems to be little doubt, exactly the same. There appeared at first distinct ossicles in the skin. With further development in this direction, these ossifications touched each other, forming a closed shield, the single elements of which were connected by suture.

As soon as this shield became connected with the endoskeleton, it found a support, many of the sutures disappeared, and the elements of the shield were disposed according to the arrangement of the endoskeleton.

In the above way the costal plates were developed. The ossicles, finding a support on the ribs, co-ossified with them and with each other.

The plastron has developed in the same way. The basis of the plastron probably consisted of dermal ossifications, generally called 'abdominal ribs.' By the increase of these dermal ossifications, the 'abdominal ribs,' the clavicles, and interclavicle were absorbed, forming a solid shield, in which the clavicles and interclavicle were transformed into epiplastron and endoplastron.

The oldest condition of the plastron of the *Testudinata*, therefore, was solid, and not pierced by fontanelles.

The oldest known representative of the *Testudinata*, *Proganochelys* (G. BAUR, 'Ueber den Ursprung der Extremitäten der Ichthyopterygia,' in *Bericht über die xx. Vers. des Oberrhein. Geol. Vereins*, Stuttgart, 1887, pp. 17, 18), from the triassic of Württemberg, confirms this opinion.

Embryology has nothing to say in this regard. The whole plastron (with exception, perhaps, of the epiplastron) is of dermal origin, and has nothing to do with the endoskeleton; but the ontogenesis of the exoskeleton is of no value for phylogenesis.

There are many authors (especially Cope and Dollo) who think that the representatives of the *Dermochelydidæ* (*Sphargididæ*), *Dermochelys* de Bl. and *Psephophorus* v. Meyer, are original forms; and Cope has created a peculiar group, '*Athecæ*,' for these and some allied genera (*Protostega*, Cope; *Protosphargis*, Cap.).

I cannot agree with this opinion, but consider these forms as the most specialized of the sea-turtles.

One group has developed from a form of *Testudinata* with well-developed carapace and plastron, by dissolution of their elements, into single ossicles, connected by suture (*Dermochelys*, *Psephophorus*). The other group has developed from a form of *Testudinata* by rudimentation of the costal plates (*Protostega*, *Protosphargis*).

The enormous *Chelonia Hoffmanni*, Gray, which has the costal plates very little developed, and the marginals very slender, shows characters between the *Cheloniidæ* and *Protostegidæ*, especially *Protosphargis*, and must rank as a different genus, which I propose to call '*Allopleuron*' (the generic characters are, costal plates, even in the adult, very little developed, covering only one-half of the rib; marginals very slender).

There have never been found mosaic-like dermal ossifications, neither in *Protostega* nor in *Protosphargis*. The plates considered by Professor Cope as probably belonging to the carapace belong to the plastron. The marginals have not disappeared, as in the *Dermochelydidæ*, but are present; those of *Protosphargis*, described by Capellini as probably phalangeal bones, resemble very much these elements in *Allopleuron*.

Sea-turtles have probably been developed at different times and in different localities, in the same way as the gigantic tortoises. The species of the Galapagos Islands are not directly related to those of the islands round Madagascar. Both have originated from two different stocks, — the first from some form of the American continent, the second from some one of African type.

G. BAUR.

New Haven, Conn., March 4.

End of the Swindler.

IT will give undoubted satisfaction to his many victims to learn that the 'swindling geologist,' whose depredations have been so frequently noted in your columns, has been lately convicted of stealing a number of microscopic objectives from the University of Cincinnati, and sentenced to spend five years at hard labor in the Ohio Penitentiary. He was sentenced under the name of O. L. Syrski, but admitted having pursued his calling under a variety of *aliases*, such as Taggart, Vasile, Ellison, Cameron, Douglas, Strong, Lee, Arundal, and Lesquereux. A valuable microscopic objective, found in his possession, awaits identification by the owner.

CHAS. H. GILBERT.

Cincinnati, March 9.

A Critique of Psychophysic Methods.

I READ with care the comment by Dr. Boas upon my article in the *American Journal of Psychology*, and carry away from it the impression that there is less difference of opinion between us than Dr. Boas supposes. The question is not one of fact, but of interpretation. We all admit that there is a psychophysic fact for which the word 'threshold' is a good name; but the important question is, How shall we theoretically understand the conception, and what place shall we allow it in the development of an experimental psychology? Fechner makes it rank as by all means the most important factor in psychophysics, and is willing to sacrifice Weber's law before yielding the supreme and fundamental fact of the threshold. He is led to this view by the method of the 'just observable difference,' and by the neglect of the other two methods. This entire structure I regard as reared upon an illogical basis, and a psychophysics based upon the mathematical methods as very different and much sounder than the other. The threshold as a practical, empirical fact, I not only fully admit, but even suggest methods of further developing its utility; but its theoretical importance with reference to the establishment of a psychophysic law I regard as almost *nil*, its true importance lying in another direction. This, I trust, defines my position clearly. A single illustration may not be out of place. Dr. Boas says that a balance has a threshold, and I accept the comparison. This threshold is something to be eliminated, and that balance is the finest that has the least of this characteristic. The theoretical balance upon which mechanics works out its principles has no threshold. But apart from this, I think the physicist will agree with me that it leads to more useful and scientific conceptions to regard every particle that is placed upon the pan of the balance as producing an effect alike in kind, and differing only in degree from that produced by a mass sufficient to turn the balance. There is no point where a new factor enters, and the turning of the balance is a merely empirical fact. Returning to the psychophysical methods, I should state the case thus: it is generally admitted that the basis of the method of the "right and wrong cases," as of the "average error," ultimately rests upon the fact that the probabilities of my making errors of various degrees follow the path traced by the probability curve. This is the fundamental fact of the entire science of psychophysics. Now, this curve is a *continuous* one, and has no break in it, no point characterized by any special peculiarity, no threshold in any true sense.

A word as to my misrepresenting the views of my opponents. The important point is, not what the upholders really do say, but what logically follows from the position they take. If they do not say what I attribute to them, it is because they are inconsistent; and I have guarded myself against this misunderstanding by at times stating, and elsewhere unmistakably implying, that I was dealing with the logical consequences of the threshold theory, and not with that particular portion of it that its adherents happened to employ.

The second point in Dr. Boas's criticism is a real difference of opinion between us. He thinks "doubtful" answers should be admitted in experimentation: I most emphatically object to them. In my paper I regarded the objections to allowing such answers as so necessarily following from the theory of the "right and wrong cases" method, that a full statement of the reasons was superfluous. Any one of half a dozen reasons is enough to show the impropriety of the "doubtful" answers. For instance: it is admitted that the methods should be as comparable, one with the other, as possible. Now, the method of the "average error" depending upon the same principle as that of the "right and wrong cases," allows no doubtful answers. Again: there is no reason for singling out "doubtful" answers as any thing peculiar. Why not make a special rubric of unusually confident answers? And if we do, as Dr. Boas suggests, make a threshold where doubtful answers no longer occur, that threshold will vary so much in different individuals, etc., that it will invalidate a large share of the results. And what shall I say when some one else proposes a threshold for another degree of confidence, say, the point where one is sufficiently sure of the correctness of one's answer to risk money upon it, and so on, *ad infinitum?* If you mean that this subjective feeling is worth taking account of, I fully concord, and will welcome the skilful observation of this feeling as an important contribution to psychophysics. JOSEPH JASTROW.

Baltimore, March 12.

On the Sense of Taste.[1]

AT the Philadelphia meeting of the American Association we presented a paper upon the 'Delicacy of the Special Senses,'—a topic upon which we have since continued our investigations from time to time.[2]

The method pursued in the following experiments was as follows:—

Solutions of known strength were made of the substances to be tasted; then, by successive dilutions, several series of solutions were made from these, each one in the series being of one-half the strength of the preceding one. The bottles containing these solutions, and several bottles of water, were placed without regard to order, and the person to be experimented upon was requested to separate them into their proper groups by tasting them. In each series the last solution was so dilute as to be beyond recognition. All unrecognized solutions were classified as water.

We chose for our tests the following typical substances. The strength of the initial solution of each is given below.

1. (Bitter) quinine, one part in 10,000 parts of water.
2. (Sweet) cane-sugar, one part in 10 parts of water.
3. (Acid) sulphuric acid, one part in 100 parts of water.
4. (Alkaline) sodium bicarbonate, one part in ten parts of water.
5. (Saline) sodium chloride, one part in 100 parts of water.

The attempt was made to include other substances, as aromatics, in the test; but it was soon found that the odor betrayed their presence without the aid of the sense of taste.

Other investigators have added astringents as a sixth class, but these substances are so often recognizable by odor, color, or some special taste not purely astringent, that it was thought best not to include them.

Tests by the method above described were made upon 128 persons; 82 being male, and 46 female observers.

The following table shows the amount of each substance which could be detected by the average observer:—

Substances.	Male Observers detected.	Female Observers detected.
Quinine . . .	1 part in 392,000	1 part in 456,000
Sugar . . .	" " 199	" " 204
Acid	" " 2,080	" " 3,280
Soda	" " 98	" " 126
Salt	" " 2,240	" " 1,980

From the above results the following conclusions may be drawn:—

1. The sense of taste is vastly more delicate for bitter substances than for any others. It is possible to detect quinine in a solution that is only $\frac{1}{2000}$ the strength of a sugar solution, and we have previously shown (*loc. cit.*) that quinine is only $\frac{1}{10}$ as bitter as strichnine.

2. The order of delicacy is, bitter, acid, salt, sugar, and alkali.

3. The sense of taste appears to be more delicate in women than in men. This is true in the case of all the substances excepting salt. As we had found a similar difference in favor of female observers in an earlier and independent set of experiments, which agreed in every essential particular with the results of the present test, we do not regard it as an accidental difference, or as likely to disappear in more extended investigations.

Marked differences in the delicacy of the sense of taste of different individuals were met with in the course of these experiments.

[1] Paper read at the New York meeting of the American Association for the Advancement of Science, August, 1887.

[2] See Relative Bitterness of Different Bitter Substances, by E. H. S. Bailey and E. C. Franklin, in *Proceedings of the Kansas Academy of Sciences*, 1885; Relative Sweetness of Sugars, by E. H. S. Bailey, in *Report of Kansas Board of Agriculture*, 1884; The Sense of Smell, by E. L. Nichols and E. H. S. Bailey, in *Nature*, xxxv. p. 74.

There were persons who could place in the proper class, solutions containing one part of quinine in 500,000, and other substances in correspondingly high dilution, while some failed to detect solutions of more than three times the above strength. In how far this was due to education, we are unable to say. Among the men examined were many who have been accustomed to handling and recognizing drugs and medicines, and yet even these were frequently surpassed by female observers who had no such training.

In some previous experiments upon the sense of smell, of which an account appeared in *Nature* (*loc. cit.*), we noted almost as marked superiority on the part of male observers.

In a few cases, the ability to detect a dilute sweet was accompanied by a lack of ability to detect dilute bitters. This peculiarity was, however, far from being a general one.

As quinine is so largely used as a medicine, especially in the Western States, it was thought that its habitual use might dull the sense of taste for this particular substance. Among the observers subjected to our experiments, the use or disuse of quinine seemed to have had no especial influence.

The experiments just described suggested several interesting questions upon which we were unable to enter. How many, for instance, of these substances, taken of equal delicacy-strength, could be detected together in a mixture, in what order would they be detected, and by what portion of the tongue or organs of taste? Would all observers recognize them in the same order as to time? What would be the influence of the temperature of a solution tasted, upon the delicacy of the sense of taste?

As to the degree of accuracy with which our results give the average delicacy of the human sense of taste for the substances in question, we are led to believe from their substantial agreement with determinations based upon the previous set of experiments already alluded to, alike in the matter of absolute delicacy, of relative delicacy, for the various substances used, and of relative sensitiveness of male and female observers, that they are but slightly influenced by individual idiosyncrasies, and may be regarded as fairly representative.

E. H. S. BAILEY.
E. L. NICHOLS.

On New Facts relating to Eozoon Canadense.

IN the February number of the *Geological Magazine* there is an interesting article by Sir J. W. Dawson, 'On New Facts relating to Eozoon Canadense.' In paragraph 9, 'Continuity and Character of the Containing Deposits,' there are some remarks respecting the stratigraphy of the Archæan or older crystalline rocks of Canada upon which I wish to make a few comments.

The author does not indicate what are, in his opinion, "the extravagant statements respecting the older crystalline rocks now being made," nor by whom they have been made. Neither does he state what portion of the Laurentian system is referred to under the term 'Middle Laurentian,' nor where he has recently examined it. I am not aware that Sir W. Logan ever used the term 'Middle Laurentian.' As regards the 'continuity of the great limestones' over certain areas, and their intimate association and interbedding with the gneisses, both orthite and anorthite, it has, so far as I know, never been questioned. In some cases, however, the limestones are very irregular, and occur in longish, more or less lenticular bands interleaved with the gneisses, often in such a manner as to suggest an origin posterior to that of the gneisses, or, rather, to that of the strata from which they have been produced. It is, I think, more than probable that original sedimentation of calcareous matter, and subsequent segregation, have both operated in producing the phenomena now observed in connection with these great limestone belts, the latter somewhat analogous to that which has produced the great 'quartz belts' in the Nova Scotia goldfields.

I must entirely dissent from the views expressed by the author in correlating any of the so-called Upper Laurentian anorthosites of the vicinity of St. Jerome, or elsewhere, with the Huronian rocks west of Lake Superior. The massive anorthosites, as I have elsewhere stated, are clearly intrusive, and the surrounding gneisses and limestones do not pass beneath them; and there are no grounds whatever for regarding them as an unconformable Upper Laurentian series. On p. 4, 'Report of Progress, Geological Survey of Canada' 1879–80,' I wrote, "If the foregoing determinations by Mr. Vennor, which are given in his own words, are correct, they seem very conclusively to prove, what I have already stated to be my opinion, that the labradorite or Norian rocks of Hunt do not constitute an Upper Laurentian formation, but occur in part as unstratified intrusive masses, and in part as interstratifications with the orthoclase gneisses, quartzites, and limestones of the Laurentian system." It is satisfactory to find that Sir William Dawson is now disposed to admit that the "great masses of labradorite may be intrusive;" but when these are eliminated, nothing remains of the Upper Laurentian as defined in any of these areas, from the Moisie River to St. Jerome; and unless the interstratified anorthite gneisses are made Upper Laurentian, the term, so far as the Norian or labradorite rocks of the areas named are concerned, must be abandoned, and I would reiterate what I wrote in 1884 ('Descriptive Sketch of the Physical Geography and Geology of Canada, 1884'): —

"As regards the so-called Norian or Upper Laurentian formation, I have no hesitation in asserting that it has as such no existence in Canada, its theoretical birthplace. Wherever these Norian rocks have been observed, they are either intimately and conformably associated with the ordinary orthoclase and pyroxene gneisses, or they occur as intrusive masses when they present no gneissoid or bedded structure. They clearly cut the surrounding gneiss, and are probably due to volcanic or other igneous agency in the Laurentian age."

Considerable further investigation since the above was written has entirely supported the view then expressed.

ALFRED R. C. SELWYN.

Ottawa, March 13.

Queries.

30. POISONOUS JELLY-FISH. — Last summer, while bathing on the Maine coast, I had what was to me a novel and not very enjoyable experience. While swimming I happened by accident to kick some sort of an animal. For an instant the feeling that passed over my feet was like a slight electric shock. Of course, I turned to see what the animal was, and, from the glimpse which I had, I should call it a red jelly-fish. For three or four hours after, my feet were slightly inflamed and very painful, the feeling being like that caused by a burn. Afterwards I learned that a certain kind of jelly-fish was said by fishermen thereabouts to be poisonous. Can you tell me through your columns about this animal, what it is, and how it stings, shocks, or poisons? What is the remedy for its poisons?

ZOÖ.

Boston, Mass., Feb. 29.

Answers.

30. POISONOUS JELLY-FISH. — The above doubtless refers to the effects of our common large red jelly-fish (*Cyanea arctica*). Many jelly-fishes have the power of stinging soft-skinned animals, and in this way ordinarily kill and secure their prey; but there are only a few species that have nettling threads powerful enough or long enough to sting the human skin. On our New England coast the only ones that are able to sting thus are the *Cyanea*, referred to above, and the Portuguese man-of-war (*Physalia*); but the latter is not common, and is rarely, if ever, found on the shore north of Cape Cod. The *Cyanea* stings many persons very severely, especially if the tentacles come in contact with a tender part of the skin, as the face, lips, eyes, or between the fingers, and of course on any part of the body that is ordinarily covered; but in my experience they will not sting the palms of the hand. The sensation is much like that of the sting of a nettle ordinarily; but in some cases, or with some persons particularly sensitive to the poison, it results in numbness, swellings, and subsequent eruptions, and even ulcerations. The *Physalia* stings much more severely than *Cyanea*, and is able to cause temporary paralysis of the arm or leg; and in some experiments it has been found to act in such a way as to affect the heart: perhaps in a severe case it might even cause paralysis of the heart. The nature of the poison is unknown, but it must be very powerful, for the quantity is minute.

A. E. V.

New Haven, March 10.

BOOK-NOTES.

—'Recent Developments of Electricity as an Industrial Art,' by Schuyler S. Wheeler, is the subject of a four-page supplement in the number of *Harper's Weekly* published recently.

—D. C. Heath & Co. of Boston will issue soon 'Ten Years of Massachusetts,' by Raymond L. Bridgman. It pictures the development of the Commonwealth as seen in its laws, regarding the laws as the expression of the 'common sense' of the people. They also publish, March 10, Emile Souvestre's 'Un Philosophe Sous Les Toits,' edited by Prof. W. H. Fraser of the University of Toronto. The 'Philosophe' was awarded a prize by the French Academy, as a work calculated to promote the advancement of morality.

Calendar of Societies.

Philosophical Society, Washington.

March 17.—John Murdoch, An Arch of Ice formed by Horizontal Pressure; H. G. Ogden, Distortion in Plane-Table Sheets; William Hallock, The Flow of Solids.

Engineers' Club, Philadelphia.

March. 3.—A. Wells Robinson, Dredging Machinery; C. Henry Roney, The Printing Telegraph Apparatus of the International Printing Telegraph Co.; Morris P. Janney, An Electric Water Level Indicator, for Steam Boilers.

Connecticut Academy of Arts and Sciences, New Haven.

March 21.—Simeon E. Baldwin, The Roman and American Law of Undutiful Wills.

Boston Society of Natural History.

March 21.—F. W. Putnam, The Great Serpent Mound in Adams County, O.; J. Walter Fewkes, Origin of the Present Form of the Bermudas.

Society of Arts, Boston.

March 22.—T. M. Drown, Chemical Analysis of Drinking-Water; William F. Chester, Johnson Heat Regulating System.

American Academy of Arts and Sciences, Boston.

March 14.—David G. Lyon, Historical Study at Babylon in the Sixth Century, B. C.; Edward S. Ritchie, An Instrument for Determining the Direction and Velocity of Water-Currents below the Surface.

Appalachian Mountain Club, Boston.

March 14.—Percival Lowell, An Ascent of Shirane San, Japan; Edward S. Holden and R. B. Lawrence, The Lick Observatory.

March 20.—J. Ritchie, jun., Account of the Winter Trip to Jackson, N.H.; Joseph H. Sears, A Trip through the Jotunheim Mountains, Norway.

Engineers' Club, St. Louis.

March 7.—Professor Gale, Transmission of Power by Belting.

Science Club, Lawrence, Kan.

March 9.—F. B. Miller, Experience on a District Telegraph; Harry Buckingham, The Argo Smelter; E. H. S. Bailey, The Constitution of Matter.

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SCIENCE

FRIDAY, MARCH 30, 1888.

THE ANNUAL INQUIRY into the management of the Government Printing-Office by a committee of the National House of Representatives is now in progress. It matters little what conclusions this committee may reach, if, like its predecessors, it does not devise some method of hastening not only the printing of Congress, but also that of the departments. Nowhere is this delay more keenly felt than in the scientific bureaus. Much of the material gathered in these with great labor and expense loses value with delay in publication. Take the work of the United States Geological Survey, for instance. Although the manuscript for the eighth annual report has been completed, the seventh has not yet been printed. The eighth report contains, among other things, an able discussion of the Trenton limestone as a source of petroleum and natural gas, by Professor Orton, State geologist of Ohio. This is a subject upon which information is most eagerly sought in many parts of the country, and it should be published immediately. But there is no probability that it will appear for a year or more, and in the mean time no one can tell what new discoveries or developments may be made. A large number of bulletins issued by the Geological Survey are also in the hands of the printer, with no immediate prospect of their being finished. The cost of printing these reports is very small in comparison with that of their preparation, and some means ought to be devised for their speedy appearance after the 'copy' goes to the printer.

THERE ARE SEVERAL BRANCHES of scientific work pursued in Washington, at the expense of the government, which are still in need of proper, systematic, scientific direction. This is not true of the Coast Survey, Naval Observatory, the Geological Survey, the Fish Commission, or the Smithsonian Institution and the National Museum. In each of these there is a general purpose which is intelligently pursued. But in some other departments, notably in the Agricultural Department, while there is much valuable original investigation going on, there is also much that is desultory and misdirected. This is not so much attributable to the workers themselves as to the lack of intelligent scientific direction. This trouble is aggravated, also, by the fact that in this and some other departments the annual appropriations are made for specific purposes; and it becomes necessary every year for the scientific worker to convince a new committee of the utility of his labors in order to secure the money to keep him employed until the next appropriation bill is passed. This leads not only to jealousies, but acts as a continuous temptation to do showy work rather than that of permanent value, and to the exaggeration of the importance of some branches of inquiry and the neglect of others of greater moment. It has also resulted in the pursuance of some investigations far beyond the limit of economical or useful inquiry, and the publication of very expensive books, which are of no value whatever to the farmers of the country, and of very little to science. What is needed is that the heads of all such departments shall be selected both for their scientific attainments and for their executive ability, and that they shall not be considered as political officers, to be changed with each new administration. They should be men capable of passing an intelligent judgment upon the scientific work performed by their subordinates, and of giving to it proper direction. As it is, the heads of the several scientific bureaus of the Agricultural Department seem all to be working independently, some wisely and to useful purpose, and some otherwise.

THE ANNUAL REPORT of the New York State Reformatory deserves a word of notice, and that word must always be one of hearty commendation. This institution, that embodies so many of the wisest and advanced views upon the true end in view in the treatment of the prisoner, and the ways that science teaches leads to such ends, is rapidly coming to be regarded as the pattern for reformatory institutions everywhere. The report for the year 1887 gives evidence that the work is going on, ever developing further improvements, and increasing the efficiency of those that have been adopted. The statistical tables showing the career of all those who have 'graduated' from the institution tell their own tale: in brief, they tell us that the public have a guaranty of protection from 90%, and of reformation from 83.3%, of all released, — certainly astounding figures. The portion of the reformatory process that strikes the average observer as most remarkable is the literary instruction. That classes in English literature, in ethics, in psychology, should be attended with a deep interest by these men, seems surprising indeed; and, when one learns the high character of this instruction, the surprise is doubled. Yet the facts are unmistakable; and the statement of the literature instructor, that the beauties of literary production can readily arouse a sympathetic chord in the minds of those whom we regard as outcasts of society, strongly suggests the remark, that, were the educational institutions outside the reformatory conducted upon equally scientific principles, there would be less need of reformatories. The managers subscribe to this statement: "The success which has attended the methods practised in the reformatory for the reclamation of first offenders is sufficiently assured and recognized among penologists and humanitarians generally, to warrant its more extended adoption in place of ordinary prison administration, which for so long a period has been in operation in the State of New York. Without attempting to disparage that system, the attention of the Legislature is respectfully called to the reports of the general superintendent, the school secretary, and the physician of the reformatory, for more detailed information in support of this recommendation."

THE ANTHROPOMETRICAL METHOD of identifying criminals, originating from Paris, has been adopted in the prison at Joliet, Ill. In addition to the photograph of the prisoner, accurate measurements of his height, the length and width of his head, the length of the left middle and little finger, of the foot, the fore-arm, the ear, the stretch of the arms, description of scars, color of the eyes, and so on, are recorded; and it is thus possible to identify prisoners assuming false names with far greater ease than was before possible. It is asserted, that, in the two years that the system has been in operation in Paris, 826 habitual criminals arrested under assumed names have been identified. Besides the practical utility of the system, it amasses very valuable statistical data contributing towards the natural history of the criminal classes.

SUPERINTENDENT MACALISTER of Philadelphia has arranged for a representative exhibit of the school-work of that city from May 9 to May 12 next. The exhibit will be placed in Horticultural Hall, and will undoubtedly attract a large number of visitors from other cities. Under Mr. MacAlister, Philadelphia's schools have become the most progressive in the country, and many other superintendents and principals will be glad to get the benefit of their methods and results. The exhibit will include all kinds of school-work that can be represented graphically or objectively; viz., manual-training, industrial-art work, sewing, kindergarten work, drawing, map-drawing, penmanship, clay-modelling, and manual work of every kind produced in the schools. The pupils' work will form the most important part of the exhibit, and will be a full and fair exhibit of the regular work done in the schools since September last. An interesting feature will be the historical exhibit. This will consist of two schoolrooms so fitted up as to represent and contrast the arrangement and conveniences for public-school education furnished by Philadelphia to-day and half a century ago. This exhibit will unquestionably prove a strong stimulus to progress and improvement to the teachers and pupils of the Philadelphia schools, as well as an attractive object of interest to those in other cities.

ADDRESS OF HON. GARDINER G. HUBBARD, PRESIDENT OF THE NATIONAL GEOGRAPHIC SOCIETY, AT ITS FIRST MEETING, MARCH, 1888.

I AM not a scientific man, nor can I lay claim to any special knowledge that would entitle me to be called a 'geographer.' I owe the honor of my election as president of the National Geographic Society simply to the fact that I am one of those who desire to further the prosecution of geographic research. I possess only the same general interest in the subject of geography that should be felt by every educated man.

By my election you notify the public that the membership of our society will not be confined to professional geographers, but will include that large number who, like myself, desire to promote special researches by others, and to diffuse the knowledge so gained among men, so that we may all know more of the world upon which we live.

By the establishment of this society, we hope to bring together (1) the scattered workers of our country, and (2) the persons who desire to promote their researches. In union there is strength, and through the medium of a national organization we may hope to promote geographic research in a manner that could not be accomplished by scattered individuals or by local societies; we may also hope (through the same agency) to diffuse the results of geographic research over a wider area than would otherwise be possible.

The position to which I have been called has compelled me to become a student. Since my election I have been trying to learn the meaning of the word 'geography,' and something of the history of the science to which it relates. The Greek origin of the word (ἡ γῆ, 'the earth;' and γράφω, 'I write') betrays the source from which we derived the science, and shows that it relates to a description of the earth. But the 'earth' known to the Greeks was a very different thing from the earth with which we are acquainted.

To the ancient Greek it meant land; not all land, but only a limited territory, in the centre of which he lived. His earth comprised simply the Persian Empire, Italy, Egypt, and the borders of the Black and Mediterranean Seas, besides his own country. Beyond these limits the land extended indefinitely to an unknown distance, till it reached the borders of the great ocean which completely surrounded it.

To the members of this society the word 'earth' suggests a very different idea. The term arouses in our minds the conception of an enormous globe suspended in empty space, one side in shadow, and the other bathed in the rays of the sun. The outer surface of this globe consists of a uniform, unbroken ocean of air, enclosing another, more solid surface (composed partly of land, and partly of water), which fairly teems with countless forms of animal and vegetable life. This is the earth of which geography gives us a description.

To the ancients the earth was a flat plain, solid and immovable, and surrounded by water, out of which the sun rose in the east, and into which it set in the west. To them 'geography' meant simply a description of the lands with which they were acquainted.

Herodotus, who lived about the year 450 B.C., transmitted to posterity an account of the world as it was known in his day. We look upon him as the father of geography as well as of history. He visited the known regions of the earth, and described accurately what he saw, thus laying the foundations of *comparative geography*.

About 300 years B.C., Alexander the Great penetrated into hitherto unknown regions, conquered India and Russia, and founded the Macedonian Empire. He sent a naval expedition to explore the coasts of India, accompanied by philosophers or learned men, who described the new countries discovered and the character of their inhabitants. This voyage may be considered as originating the science of political geography, or the *geography of man*.

About the year 200 B.C., Eratosthenes of Cyrene, the keeper of the Royal Library at Alexandria, became convinced, from experiments, that the idea of the rotundity of the earth, which had been advanced by some of his predecessors, was correct, and attempted to determine upon correct principle the magnitude of the world. The town of Cyrene, on the river Nile, was situated exactly under the tropic, for he knew that on the day of the summer solstice the sun's rays illuminated at noon the bottom of a deep well in that city. At Alexandria, however, on the day of the summer solstice, Eratosthenes observed that the vertical finger of a sun-dial cast a shadow at noon, showing that the sun was not there exactly overhead. From the length of the shadow he ascertained the sun's distance from the zenith to be 7°12′, or one-fiftieth part of the circumference of the heavens; from which he calculated, that, if the world was round, the distance between Alexandria and Cyrene should be one-fiftieth part of the circumference of the world. The distance between these cities was 5,000 stadia, from which he calculated that the circumference of the world was fifty times this amount, or 250,000 stadia. Unfortunately we are ignorant of the exact length of a stadium, so we have no means of testing the accuracy of his deduction. He was the founder of *mathematical geography*.

It became possible through the labors of Eratosthenes to determine the location of places on the surface of the earth by means of lines corresponding to our lines of latitude and longitude. Claudius Ptolemy, in the second century of the Christian era, made a catalogue of the positions of plans as determined by Eratosthenes and his successors, and, with this as his basis, he made a series of twenty-six maps, thus exhibiting at a glance, in geographical form, the results of the labors of all who preceded him. To him we owe the art of map-making, — the *origination of geographic art*.

We thus see that when Rome began to rule the world, the Greeks had made great progress in geography. They already possessed comparative, political, and mathematical geography, and geographic art, or the art of making maps. Then came a pause in the progress of geography.

The Romans were so constantly occupied with the practical affairs of life, that they paid little attention to any other kind of geography than that which facilitated the administration of their empire. They were great road-builders, and laid out highways from Rome to the farthest limits of their possessions. Maps of their military roads were made, but little else. These exhibited with accuracy the less and greater stations on the route from Rome to India, and from Rome to the farther end of Britain.

Then came the decline and fall of Rome, and with it the complete collapse of geographical knowledge. In the dark ages, geography practically ceased to exist. In the typical map of the middle ages, Jerusalem lay in the centre, with Paradise on the east, and Europe on the west. It was not until the close of the dark ages that the spirit of discovery was re-awakened. Then the adventurous Northmen from Norway and Sweden crossed the ocean to Iceland.

From Iceland they proceeded to Greenland, and even visited the mainland of North America about the year 1000 A.D., coasting as far north as New England; but these voyages led to no practical results, and were forgotten, or looked upon as myths, until within a few years. For hundreds of years geography made but little advance, and the discoveries of five centuries were less than those now made in five years. In the fourteenth or fifteenth century the mariner's compass was introduced into Europe from China, and it then became possible to venture upon the ocean far out of sight of land. Columbus, instead of coasting from shore to shore like the ancient Northmen, boldly set sail across the Atlantic. To many of his contemporaries it must have seemed madness to seek the east by thus sailing towards the west, and we need hardly wonder at the opposition experienced from his crew. The rotundity of the earth had become to him an objective reality, and in sublime faith he pursued his westward way. Expecting to find the East Indies, he found America instead. Five centuries had elapsed since the Northmen had made their fruitless voyages to these shores, and their labors had proved to be barren of results. The discovery of Columbus, however, immediately bore fruit. It was his genius and his perseverance alone that gave the New World to the people of Europe, and he is therefore rightfully entitled to be called the discoverer of America. His discovery was fraught with enormous consequences, and it inaugurated a new era for geographic research. The spirit of discovery was quickened, and geographic knowledge advanced with a great leap. America was explored, Africa was circumnavigated. Magellan demonstrated the rotundity of the world by sailing due west until he reached his starting-point. Everywhere, all over the civilized world, the spirit of adventure was aroused. Navigators from England, Holland, France, and Spain rapidly extended the boundaries of geographical knowledge, while explorers penetrated into the interior of the new lands discovered. The mighty impetus given by Columbus set the whole world in motion, and it has gone on moving ever since with accelerated velocity.

The great progress that has been made can hardly be realized without comparing the famous Borgia map, constructed about one hundred years before the discovery of America, with the modern maps of the same countries; or Hubbard's map of New England, made two hundred years ago, with the corresponding map of to-day. The improvements in map-making originated with Mercator, who, in 1556, constructed his cylindrical projection of the sphere. But it was only during the last one hundred years that great progress was made. Much yet remains to be done before geographic art can fully accomplish its mission.

The present century forms a new era in the progress of geography, — the era of organized research. In 1830 the Royal Geographical Society of England was founded, but it already forms a landmark in the history of discovery. The Paris Society preceded it in point of time, and the other countries of Europe soon followed the example. Through these organizations, students and explorers have been encouraged and assisted, and information systematically collected and arranged. The wide diffusion of geographical knowledge through the medium of these societies, and the publicity of the discussions and criticism that followed, operated to direct the current of exploration into the most useful channels. Before organized effort, darkness gave way at every step. Each observer added fresh knowledge to the existing store, without unnecessary duplication of research. The reports of discoveries were discussed and criticised by the societies, and the contributions of all were co-ordinated into one great whole.

America refuses to be left in the rear. The American Geographical Society, so long and wisely presided over by Chief-Justice Daly, has kept pace with the foreign societies. Explorers from America are in every land and on every sea. Already she has contributed her quota of martyrs in the frozen North, and has led the way into the torrid regions of Africa. The people of Europe, through Columbus, opened up a new world for us; and we, through Stanley, have discovered a new world in the old, for them.

Much has been done on land, little on the other three-quarters of the earth's surface. But here America has laid the foundations of a new science, — the geography of the sea.

Our explorers have mapped out the surface of the ocean, and discovered the great movements of the waters. They have traced the southward flow of the Arctic waters to temper the climate of the torrid zone. They have followed the northward set of the heated waters of the equator, and have shown how they form those wonderful rivers of warm water that flow, without walls, through the colder waters of the sea, till they strike the western shores of Europe and America, and how they render habitable the almost arctic countries of Great Britain and Alaska. They have even followed these warm currents farther, and shown how they penetrate the Arctic Ocean to lessen the rigors of the Arctic cold. Bravely but vainly have they sought for that *ignis fatuus* of explorers — the open polar sea — produced by the action of the warm waters from the south.

American explorers have sounded the depths of the ocean, and discovered mountains and valleys beneath the waves. They have found the great plateaus on which the cables rest that bring us into instantaneous communication with the rest of the world. They have shown the probable existence of a vast submarine range of mountains, extending nearly the whole length of the Pacific Ocean, — mountains so high that their summits rise above the surface, to form islands and archipelagoes in the Pacific. And all this vast region of the earth, which, a few years ago, was considered uninhabitable on account of the great pressure, they have discovered to be teeming with life. From the depths of the ocean they have brought living things, whose lives were spent under conditions of such pressure that the elastic force of their own bodies burst them open before they could be brought to the surface; living creatures whose self-luminous spots supplied them with the light denied them in the deep abyss from which they sprang, — abysses so deep that the powerful rays of the sun could only feebly penetrate to illuminate or warm.

The exploring vessels of our Fish Commission have discovered in the deep sea, in one single season, more forms of life than were found by the 'Challenger' Expedition in a three-years' cruise. Through their agency we have studied the geographical distribution of marine life; and in our marine laboratories, explorers have studied the life-history of the most useful forms.

The knowledge gained has enabled us to breed and multiply at will; to protect the young fish during the period of their infancy (when alone they are liable to wholesale destruction); finally to release them in the ocean, in those waters that are most suitable to their growth. The fecundity of fish is so great, and the protection afforded them during the critical period of their life so ample, that it may now be possible to feed the world from the ocean, and set the laws of Malthus at defiance. Our geographers of the sea have shown that an acre of water may be made to produce more food for the support of man than ten acres of arable land. They have thrown open to cultivation a territory of the earth constituting three-quarters of the entire surface of the globe.

And what shall we say of our conquests in that other vast territory of the earth, greater in extent than all the oceans and the lands put together, — the atmosphere that surrounds the world.

Here, again, America has led the way, and laid the foundations of a geography of the air. But a little while ago, and we might have truly said with the ancients, "The wind bloweth where it listeth, and we know neither from whence it comes, nor whither it goes;" while now our explorers track the wind from point to point, and telegraph warnings in advance of the storm.

In this department — the geography of the air — we have far outstripped the nations of the world. We have passed the mob-period of research, when the observations of multitudes of individuals amounted to little, from lack of concentrated action. Organization has been effected. A central bureau has been established in Washington, and an army of trained observers have been dispersed over the surface of the globe, who all observe the condition of the atmosphere according to a preconcerted plan.

The vessels of our navy, and mercantile marine of our own and other countries, have been impressed into the service: thus our geographers of the air are stationed in every land, and traverse the waters of every sea. Every day, at the same moment of absolute time, they observe and note the condition of the atmosphere at the part of the earth where they happen to be, and the latitude and longitude of their position. The collocation of these observations gives us a series of what may be termed 'instantaneous photographs' of the condition of the whole atmosphere. The co-ordination of the observations, and their geographical representation upon a map, are undertaken by a staff of trained experts in the central bureau in Washington, and through this organization we obtain a weather-map of the world for every day of the year. We can now study at leisure the past movements of the atmosphere, and from these observations we shall surely discover the grand laws that control aerial phenomena. We shall then not only know, as we do at present, whence comes the wind and whither it goes, but be able to predict its movements for the benefit of humanity.

Already we have attained a useful though limited power of prediction.

Our central bureau daily collects observations by telegraph from all parts of this continent, and our experts are thus enabled to forecast the probabilities by a few hours. Day by day the results are communicated to the public by telegraph in time to avert disaster to the mariners on our eastern coast, and facilitate agricultural operations in the Eastern and Middle States.

Although many of the predictions are still falsified by events, the percentage of fulfilments has become so large as to show that continued research will in the future give us fresh forms of prediction, and increase the usefulness of this branch of science to mankind.

In all departments of geographical knowledge, Americans are at work. They have pushed themselves into the front rank, and they demand the best efforts of their countrymen to encourage and support.

When we embark on the great ocean of discovery, the horizon of the unknown advances with us, and surrounds us wherever we go. The more we know, the greater we find is our ignorance. Because we know so little, we have formed this society for the increase and diffusion of geographical knowledge. Because our subject is so large, we have organized the society into four broad sections, relating to the geography of the land (H. G. Ogden, vice-president), the sea (J. R. Bartlett, vice-president), the air (A. W. Greely, vice-president), the geographical distribution of life (C. H. Merriam, vice-president); to which we have added a fifth, relating to the abstract science of geographic art, including the art of map-making, etc. (A. H. Thompson, vice-president). Our recording and corresponding secretaries are Henry Gannett and George Kennan.

We have been fortunate indeed to secure as vice-presidents and secretaries men learned in each department, and who have been personally identified with the work of research.

WATER-SPOUTS OFF THE ATLANTIC COAST OF THE UNITED STATES.

THE Hydrographic Office has published a very interesting supplement to the Pilot Chart of the North Atlantic Ocean, showing the positions of water-spouts sighted by masters of vessels during January and February in the western portion of the North Atlantic. The map, which is reproduced here, is accompanied by remarks of Everett Hayden, of which we give the following abstract: —

"Although the reports now at hand for these two months were received from incoming vessels only, yet they are very characteristic, and indicate fairly well the regions where these phenomena are of most frequent occurrence.

"Before quoting the reports themselves, it may be well briefly to refer to what is known regarding the character and formation of water-spouts, which are simply special cases of whirlwinds and tornadoes, as these are special cases of cyclones, but on a much smaller scale.

"When a whirlwind is formed over the ocean, water is often drawn up the centre of the whirl some distance, owing to the suction created, and at the same time the moisture in the air is condensed as it rises, so that the name 'water-spout' is very applicable. Indeed, sometimes a spout will burst over a vessel, and flood her decks with water, as a cloud-burst does a mountain-side. When a spout is forming, its upper portion is often visible first, seeming to grow downwards from the clouds. By observing carefully with a telescope, however, it will be seen that the motion in the column itself is upwards, although the moisture in the air which is rising is condensed lower and lower down, thus rendering the whirl visible lower down continually, and making it appear to be actually descending.

"On Jan. 12, Captain Hess, American steamship 'Philadelphia,' saw four water-spouts in latitude 36° 41′ north, longitude 72° 27′ west. On the 19th, Captain Lawson, British steamship 'Lizzie English,' reports several a little farther to the eastward (latitude 36° 41′ north, longitude 71° 40′ west); and from the Dutch steamship 'Edam,' Captain van der Zee, a detailed report has been received from third officer De Boerk of a large spout sighted at 7 A.M., Jan. 21, latitude 41° 50′ north, longitude 60° 25′ west. In the last case the spout is described as being small and straight at the base, increasing in size towards the top, where it mingled with the clouds. Ascending currents could be plainly seen; there was a strong westerly gale at the time, with occasional hail and snow; temperature of the air 0° C.; water, 11°; direction of rotation of the whirl, with the hands of a watch.

"Another very complete report has been received from Captain Dexter, American steamship 'City of Para,' who saw several large spouts, Jan. 22, in latitude 31° 47′ north, longitude 74° 33′ west. The wind was strong from the north-east, and the sky overcast, with light scud, but the sea was comparatively smooth. Three huge spouts were seen at once, and six in the course of half an hour. The water seemed to be drawn up from the sea, mounting in spiral columns of tremendous thickness, with a loud, roaring sound. Some of the columns were vertical, some inclined at a considerable angle; all of them increased in size at the top, and blended with the clouds. A fine rain or mist filled the air, and continued for some time. The wind soon after changed to east.

"Perhaps the most interesting cases of all, however, are those which were reported Jan. 26, 27, and 28, for the reason that they were clearly associated with a low-barometer area of considerable energy, which moved across the Great Lakes on the 25th, and was central off Nantucket on the 26th. It has been clearly shown by the United States Signal Service, that, when tornadoes occur on land, they take place almost invariably in the southern quadrants of an area of low barometer. It might therefore be expected that whirlwinds and water-spouts would sometimes be found associated in a similar way with a cyclonic storm at sea. The following reports seem to leave no doubt that such is the case. The area of low barometer, which was central over the Great Lakes Jan. 25, barometer 29.7, gathered increased energy when it reached the Atlantic, and off Nantucket the following day the barometer read 29.2; and in the Gulf of Newfoundland, on the 27th and 28th, it read as low as 28.6. The cold, dry, north-westerly winds in the western quadrants of this cyclone, and the warm, moist air flowing into the eastern quadrants, mingled to the southward of the storm-centre, and gave rise to the conditions most favorable to the development of tornadoes on land and water-spouts at sea. Accordingly, Captain Haskell, British bark 'Shetland,' reports that on the 26th, in latitude 39° 34′ north, longitude 71° 16′ west (a little to the southward of the storm-centre), he saw a large spout; the following day (latitude 39° 12′ north, longitude 70° 44′ west) he saw several more; and on the 28th, still more. Captain Garvin, British steamship 'Orinoco,' reports that on the 27th, when entering the Gulf Stream from the north, in about latitude 37° 20′ north, longitude 70° 40′ west, the sea was covered with thick vapor from five to fifteen feet high. The heavy, low-lying clouds seemed to draw the vapor up, and many water-spouts were formed, both large and small; temperature of the water, 60° F.; air, 40°. Captain Cleary, British steamship 'River Avon,' states that on the 28th, in latitude 39° 30′ north, longitude 57° 20′ west, he saw what he took to be a heavy squall to the south-east. Upon looking at it with his glass, he saw that it was a whirlwind, raising the water to a great height. It must have been over a mile in diameter, but he hesitates to even estimate the height to which the water was raised, or the size of the spout, although it must have had terrific power. Shortly afterwards a smaller one passed close to the ship, whirling along the water, and raising the spray to a height of fully a hundred feet. Even as far south as Bermuda the conditions were the same, for on the 27th a whirlwind swept across the parishes of Southampton and Warwick, unroofing houses, blowing down trees, and damaging property generally.

"Similarly, two cyclonic storms, which seem to have originated about the Bermudas on the 10th and 12th of February, as indicated in the weather review published on the March Pilot Chart, were attended by water-spouts, at least one of which was disastrous to shipping. Feb. 10, at 9 A.M., Captain Smith, British steamship 'Ethelbald,' in latitude 28° 18′ north, longitude 74° 06′ west, reports a large spout travelling in a north-easterly direction, rotating, apparently, with the hands of a watch. The barometer was rising; fresh, variable winds, mostly southerly, and sky overcast, with very heavy rain. At this time the American bark 'Reindeer,' Captain Strandt, was about two hundred miles to the westward of the 'Ethelbald,' running up the coast towards New York, in the Gulf Stream. On the 11th the weather became squally, with light southerly winds; and at 10.30 A.M., in latitude 32° 04′ north, longitude 76° 06′ west, when the vessel was under full sail, a heavy water-spout passed over her, completely dismasting her below the heads of the three lower masts. No previous warning was received; the weather was apparently clear at the time; and the whole affair was over in a few minutes. The dismasted vessel reached Bermuda on the 16th. Again, when the second of these two cyclonic storms was central about latitude 39° north, longitude 67° west, Captain Hogan, British schooner 'Alma,' passed within two miles of a large spout which was travelling from west to east. This was very unsettled weather; wind mostly from the south-westward, but often falling calm and flying to the opposite point of the compass, where it soon died out; thunder and very vivid lightning all around the horizon, but most marked to the north-west and north-east. On the 13th (34° north, 75° west), calm and light variable airs, followed by a breeze from north-north-east, which by midnight increased to a whole gale. Similarly, Captain Paine, American barkentine 'Henry Warner,' reports that during Jan. 21, 22,

at 2 P.M., Feb. 14, latitude 30° 40′ north, longitude 73° 50′ west, and it was blowing a gale from north-north-west at the time. The meteorological conditions prevalent about this time between the Bermudas and the Atlantic coast of the United States are well illustrated by a report made by Mr. Lund, British steamship 'Rothiemay,' Captain Olsen. This vessel arrived at Philadelphia Feb. 20, from Montevideo. From Feb. 1 (latitude 19° north, longitude 58° west) to 9 (27° north, 73° west), fine, pleasant weather, with occasional showers; light to fresh breezes from south-eastward. From the 9th to the 14th (34° north, 74° west), rainy and and 23, off the coast of New Jersey, he encountered light airs going around the compass two or three times every twenty-four hours, exhibiting this same tendency towards the formation of incipient whirlwinds and water-spouts, indicative oftentimes of the gradual generation of a great cyclonic storm.

"A still later report, and one of the best and most detailed which has recently been received, relates to a spout sighted by Captain Battle, American schooner 'Ethel A. Merritt.' This was on Feb. 18, latitude 24° 02′ north, longitude 81° 14′ west, in the Gulf Stream, off Key West, about midway between the Florida Keys and the coast of Cuba, — only a week after the 'Reindeer' had been dismasted about five hundred miles to the north-eastward. There was a light breeze from the north-east at the time, and the sky was about half covered with nimbus clouds, moving slowly. Just after a light squall had passed by, the first appearance of a water-spout was indicated by the formation of a whirlwind, gradually increasing in size. It was cylindrical in shape below, spreading out above, and rotating in a direction with the hands of a watch. When within about a hundred yards of the vessel, its angular altitude was about 35°, which would indicate a height of only two hundred and fifty feet or less. It was moving to the south-west at the rate of about eight miles an hour. At the base it was transparent; and descending currents seemed to be plainly visible, causing the water at the surface to fly in all directions. A heavy shower of rain accompanied the spout, and the phenomena lasted, in all, about ten minutes.

"Although the study of such reports has already greatly increased our knowledge of the origin and nature of these interesting and often destructive phenomena, much yet remains to be done before we can hope to be able fully to understand the laws by which they are governed. That portion of the North Atlantic from the northern coast of Cuba to the 40th parallel, and from the Atlantic coast of the United States to the Bermudas, is pre-eminently a region where water-spouts are liable to occur, owing largely to the warm, moist air which hangs over the Gulf Stream, and the cool, dry air brought over it by the north-westerly winds from off the coast.

"Among desirable observations to be made, referring to water-spouts, special attention is called to the temperature of the air and water, the reading of the barometer, direction and force of the wind, and the changes which take place in each while the spout lasts; also the direction of rotation of the whirl, and an estimate of its size, character, and changes of form, with, if possible, sketches, however rough, of its appearance at the various stages of its formation and progress."

SCIENTIFIC NEWS IN WASHINGTON.

The Flow of Solids: Solids are not liquefied by Pressure. — The Law of Probabilities: a Discussion of the Doctrine of Philosophical Necessity. — Dynamite Shells: the Progress made by the Ordnance Department of the Army with Experiments with Nitro-Glycerine.

The Flow of Solids.

Mr. WILLIAM HALLOCK of the United States Geological Survey, whose paper upon a new method of making alloys was presented to the Philosophical Society a few weeks ago, read another address upon a somewhat related subject at the meeting of the same body March 17. The question whether solids, he said in substance, possessed any of the properties of liquids, or what conditions will impart such properties to them, is one of ever-increasing importance, to the student alike of molecular physics in general, or of the earth's crust in particular.

The temperature rises as we penetrate the earth: hence, if no other influence affect the substances, the earth has a liquid centre with a thin solid crust. Astronomical and mechanical facts seem to demand a considerable rigidity. Thomson has even demanded a rigidity equal to that of glass or steel. Geological phenomena require a considerable liquid-like motion. With rising temperature, as we penetrate the earth's crust, we also have rising pressure, which probably increases the rigidity of the materials. Cannot we satisfy the demands of both geology and astronomy, and also of mechanics?

In the glaciers we have the grandest examples of the flow of solids. Henri Tresca proved that lead and some other substances would flow, and follow the laws of flowing liquids. W. Spring has extended the list. Monsson actually liquefied ice by pressure. These observations have led many to advocate the idea of a liquefaction by pressure. Others having in view the results of Bunsen, Hopkins, Amazat, and others, maintain that the melting-point is raised by pressure.

Solids can be made to flow: hence that property cannot be used to distinguish solids from liquids. The essential difference between a solid and a liquid is that the relative ease of re-arrangement of the molecules in liquids is very easy, in solids very difficult. Rigidity may be briefly defined as the difficulty of re-arranging the molecules of the body in question. Can rigidity be reduced by pressure? *A priori*, it seems scarcely likely that forcing the molecules nearer together can give them greater freedom of motion. Generally rigidity is inversely as the intermolecular distances. Ice is abnormal, and cannot be taken as evidence *pro* or *con*. Lead, copper, iron, steel, are all hardened by compression. All metals are harder, more rigid, in the drawn, rolled, or hammered state than cast or annealed. The rigidity of a steel pin was raised from 95,000 to 110,000 pounds per square inch by pressure.

Two experiments were described bearing directly upon the question, and are convincing, although they gave unwelcome results to those who made them. The first was conducted under the direction of the Ordnance Department, and is given in full in the report on 'Tests of Metals, etc., for 1884,' pp. 252–285. A mixture of four parts wax and one part tallow was used as a 'straining liquid' in 'tangential' test. It was demonstrated that that mixture would not transmit pressure through a hole $\frac{3}{16}$ of an inch in diameter and $2\frac{1}{2}$ inches long, when the pressure at one end was 100,000 pounds per square inch, and at the other 30,000 pounds per square inch, or less; whereas 2,000 pounds was sufficient to overcome all friction, and force it through, when there was no back pressure: that is, the wax and tallow were rigid enough, under pressure, to maintain a difference of 70,000 pounds per square inch (100,000—30,000) at the two ends of that hole.

The second experiment was also made with the testing-machine of the Ordnance Department at Watertown, Mass. (see *American Journal of Science*, iii. 34, 1887, p. 280). In that experiment silver coins on top of paraffine and beeswax in the holder, instead of sinking through a liquid under 6,000 atmospheres, were pressed so hard against the top of the holder that their impression in the steel was easily seen and felt. The paraffine and wax were rigid enough to impress silver into steel.

Such facts lead us to believe that pressure increases rigidity; and, when we remember that the pressure at the centre of the earth is millions of atmospheres, a demand for the rigidity of steel seems trifling. What is the rigidity of steel? Simply a rigidity capable of resisting 30,000 to 100,000 pounds per square inch. But distinguished geologists have made the fatal mistake of using 'the rigidity of steel' and 'absolute rigidity' as synonymous and equivalent terms. Nothing is more misleading.

Upheavals and depressions, and other geological phenomena, are most beautiful examples of viscous flow of solids. The forces causing a glacier to flow are trifling as compared with those generated in the earth's crust by shrinking; and undoubtedly to cause any body to flow, we only need sufficient force and time.

Can pressure impart to solids the ability to change crystallographically, mineralogically, chemically? Prismatic sulphur naturally changes to octahedral, and in many other cases changes take place under ordinary conditions of pressure and temperature. We should scarcely expect pressure pure and simple to cause a re-orientation of the axes of the two crystal fragments, even if it could perfectly weld them together. Nor should we expect pressure, without heat, to impart the ability to complete the fusion of a lump of barium sulphate in sodium carbonate, even after the process had been well started by heat. Under the extremely complex conditions, it is difficult to generalize. A welding-together is not only theoretically but practically possible between two chemically clean surfaces that fit, but any operation which requires an increase of freedom in the molecules would scarcely be assisted by pressure. Cohesion and adhesion I believe to be identical, and molecular rather than molar.

The bearing of these ideas, if good, upon geological phenomena, is somewhat thus: by the action of pressure and time we might find a sandstone, or such material, compacted, and rendered coherent or even continuous, the most plastic constituents yielding most, and the most viscous retaining their shape most perfectly. Some constituents might even appear to have been fused and filled in between the rest. Certain crystallographic changes might take place, but more than the slightest chemical effect of the constituents upon each other is not to be expected. The case becomes infinitely complex, and a subject for conjecture only, if the temperature is high. An indisputable fact in this connection is that many more experiments are needed, and that they should be of such a character that each effect can be ascribed to its proper cause, and that causes and effects shall not be treated collectively, as at present.

On Probabilities.

A year ago, or more, Mr. M. H. Doolittle presented a paper to the Mathematical Section of the Philosophical Society, on the doctrine of probabilities. It gave rise to an interesting discussion at the time, which led him, at the last meeting of the section, to return to the consideration of the subject. Referring to an important change of opinion by John Stuart Mill, as shown in the eighth edition of his 'System of Logic,' and set forth in the introductory paragraphs of the chapter on 'The Calculation of Chances,' Mr. Doolittle showed that the two antagonistic schools started with two different definitions of the doctrine of chances, — one, to which he belongs, accepting the latest definition by Mill, which he adopts from Laplace; and the other, that given by Mill in the first edition of his 'Logic.'

"Probability," says Laplace, "has reference partly to our ignorance, partly to our knowledge. We know that among three or more events, one, and only one, must happen; but there is nothing leading us to believe that any one of them will happen rather than the other. In this state of indecision it is impossible for us to pronounce with certainty on their occurrence. It is, however, probable that any one of these events, selected at pleasure, will not take place; because we perceive several cases, all equally possible, which exclude its occurrence, and only one which favors it."

"To a calculation of chances, then," says Mill, "according to Laplace, two things are necessary: we know that of several events some one will certainly happen, and no more than one; and we must not know, or have any reason to expect, that it will be one of these events rather than another." Mr. Mill then expounds the doctrine formerly held by himself, to the effect that these are not the only requisites, and that Laplace has overlooked, in the general theoretical statement, a necessary part of foundation of the doctrine of chances, — the knowledge that one or the other of the events must happen, but the possession of no grounds for conjecturing which. "We must remember," explains Mill, "that the probability of an event is not a quality of the event itself, but a mere name for the degree of ground which we or some one else have for expecting it."

Having read these passages, Mr. Doolittle took up briefly the discussion of the doctrine of philosophical necessity, and referred to Edwards on 'The Freedom of the Will' as exceedingly able in the presentation of this doctrine, and one of the first, if not the very first, American book that became famous throughout the world. On the other side, he quoted from Adam Clarke's 'Commentary on the Bible' as one of the ablest opponents of philosophical necessity. Dr. Clarke's argument is, that, since there are events in the future which are uncertain, it is impossible for them to be known as certain, so that divine foreknowledge is only a knowledge of probabilities, and does not include the certain knowledge of uncertain things. Mr. Doolittle then asked his audience whether, whatever they might think of Adam Clarke's Deity, any one would claim to be a Deity of that sort himself, and argued, that, in any case, it is proper for us to base our theory of probability on human intellectual conditions, and not on divine intellectual conditions. He then said that the doctrine of probability is not peculiar in this respect. Metaphysicians say that all our knowledge is based upon our states of consciousness. We know only our states of consciousness, and although we cannot say that any probabilities exist in the nature of things, still we may presume that probabilities having a scientific basis, have in some manner their counterparts in the external world, just as we presume that other states of consciousness have their counterparts in the external world.

With regard to such probabilities, Mr. Doolittle said Mill was right in his first edition. But there still are probabilities of less scientific character that may nevertheless be made the subject of mathematical computation.

This paper was discussed for an hour by leading members of the section. Professor Harkness of the Naval Observatory accepted the definition of probabilities given by Mill in his first edition, as did also several other gentlemen connected with that institution. The gentlemen connected with the Coast Survey, on the other hand, generally accepted Mill's latest definition adopted from Laplace.

Dynamite Guns.

Among the appendixes to the 'Annual Report of the Chief of Ordnance,' soon to be published, is one prepared by Maj. George W. McKee, on 'The Present Status of Dynamite as an Explosive for Shells.' Prefacing it with a brief history of the discovery and use of nitro-glycerine, he says, —

"The Nobel's explosive gelatine, or blasting dynamite, has been used in this country by United States officers to the entire demonstration of the fact that this high explosive, contained in a shell as a bursting charge, might be fired from a gun. The ordinary blasting dynamite made by the company (some of it experimentally modified with about 3 per cent of camphor) was used, and enough shells were thrown from the bores of the old mutilated guns used in the experiment to demonstrate the fact that dynamite could be projected in shells from an 8-inch rifle gun with a 40-pound charge of powder. The great chemist Nobel never, perhaps, thought of applying his invention to this delicate test; but his powerful and wonderful gelatine, made only to be detonated in mines and the like, stood in several instances the tremendous initial shock of the gunpowder, and, by the aid of the rectangular diaphragms devised by Captain Whipple of the Ordnance Department, stood, what is thought to be equally dangerous, the heat developed by the angular velocity. If the gelatine had been especially undertaken by these chemists for a military and not an industrial agent, and enough time and means had been at hand to perfect the diaphragm, it is believed all of the shells would then have become, as they will be in future, high-explosive batteries, projected with as much safety as though they had been charged with black gunpowder."

Major McKee, in reviewing various experiments that have been conducted under the direction of the Ordnance Department, speaks of them as follows. Of the method exhibited by Mr. Snyder, he says, "He did fairly well with some of his firing at the Hook and on the Potomac, near Washington, D.C., and, as he is a man of inventive talent and an American, no one wishes him more success in his future experiments with dynamite than the men who were delegated by the government to supervise and report upon those he originally undertook." In the experiments with shells loaded with dynamite, conducted by Brevet Brig.-Gen. John C. Kelton, at Point Lobos, near San Francisco, Cal., in March, 1885, no specially camphorated or otherwise prepared explosive was used, but the shells were charged with the crude, blasting, industrial dynamite. Three rounds were fired from a 3-inch wrought-iron rifled gun, — shells with two hundred grams of dynamite, and a variable charge of projection. The target was a large rock at 157 yards distance. In the first two rounds the shell burst into innumerable pieces on striking the rock, but in the third it burst within the piece. Colonel Kelton considered this experiment as very satisfactory, since it demonstrated the possibility of employing dynamite in shells, as well as the great strength of this great explosive; and he estimates that for the effective use of these artifices, which, according to him, is to destroy ships, one-half the length of the projectile is the penetration needed, requiring 0.001 of a second, and he expects it will be successful.

After describing some experiments at Sandy Hook in 1883, Major McKee sums up the results as follows: —

"As detailed in the records, three shells were fired with fulminate-of-mercury fuzes. The fulminate was too sensitive to stand the shock, and it was found afterwards that the gelatine needed no detonator.

"Although the tests made were very few, it would nevertheless appear from them —

"(1) That the shells explode after clearing the muzzle, and therefore the detonation of the gelatine is due to some cause other than the shock of discharge, very possibly the heat generated by angular velocity.

"(2) This is corroborated by the fact that one shell passed through a 2-inch board target without explosion.

"(3) The gelatine used in these tests, not being camphorated, renders it highly probable that a certain percentage of camphor added would establish a compound which could be fired successfully in a specially constructed shell.

"(4) The gelatine does not require a fuze or detonator of any kind.

"(5) It is believed the shell which destroyed the 3.2-inch breech-loading gun broke from the shock of discharge, or admission of powder-gas, and thus detonated the gelatine."

In the summer of 1884 the Ordnance Board fired four cast-iron screw shells from an 8-inch muzzle-loading rifle, using forty pounds of powder in the gun, and from five to eight pounds of gelatine in the shells, at each discharge. The gun was mounted on a cradle, and directed at a target 383 feet distant. One of the shells burst at or near the muzzle with little comparative violence. The other three reached the target, penetrated about seven inches, and detonated from the shock. These trials led to the making of six steel shells, three of them being cast, and three forged. Analysis of the facts connected with these experiments shows —

"(1) That the 3-inch shells designed for gunpowder charge, when loaded with Hill's explosive gelatine, three months old, all cleared the gun without injuring it in the slightest.

"(2) That the shells, having to be charged through the fuze-holes with the dynamite, were necessarily packed loosely, thus subjecting the charge to the powerful action of angular velocity.

"(3) That in the trials made with the 3.2-inch gun, two Butler shells, charged with black gunpowder, broke up 'at or near the muzzle;' while of the two Butler shells charged with Nobel's gelatine, or dynamite, one broke up 'at or near the muzzle,' and the other reached the target and exploded on impact.

"(4) That in the trials made with the same 3.2-inch gun, using thin Hotchkiss shrapnel cases, charged with Nobel's dynamite or gelatine, all cleared the gun in safety (one reaching the target after passing through two-inch boards) with the exception of one, which the board reported on as follows: 'It either broke from the shock of discharge or admitted powder-gas.'

"(5) That *all* the trials with the 8-inch shells charged with *fresh* Nobel's dynamite or gelatine were successful, three of the shells detonating at the target, and one only exploding at or near the muzzle; that the gelatine used when the premature explosion took place was sixteen months on hand in this country after crossing the ocean, and therefore not such as was recommended by General Abbot, or contemplated by the board."

Major McKee's conclusions are as follows: that the United States officers undertaking the investigation of this subject were necessarily compelled to institute their inquiries *de novo*. All foreign information was so meagre, so unsatisfactory, and so shrouded in mystery, in accordance, doubtless, with the policy of the European governments, that it was seen, after careful investigation, that all trustworthy knowledge would have to be gleaned by Americans through experience. In obtaining this experience, devices have been experimented with, invented by Mr. Snyder, who presented several plans; Mr. C. P. Winslow, with a nitro-glycerine shell, in which the glycerine and combined nitric and sulphuric acids are placed in separate glass vessels within the shells; Mr. Garrick, with a mortar and projectile for nitro-glycerine; Mr. D. P. Hill, with an 8-inch explosive gelatine shell; Mr. Stevens, with a double shell for high explosives; Mr. Graydon, with a shell containing the dynamite in capsules; Mr. Taylor, who brought his own gun, and attempted to use dynamite as a propulsive charge; and Mr. Smolianoff, experiments with whose gun were made as late as last October.

In all these trials, Major McKee said, as to the practicability of using dynamite as a shell-explosive, that it was well understood by the officers undertaking them that the crude blasting compound of industry, which was the only available explosive attainable, was not the eventual product of chemistry which would satisfactorily answer this purpose. It was known that great improvements had been made in the dynamites of all kinds, especially in blasting dynamite, or gelatine of Nobel, and that these compounds presented in transportation by all modern conveyances, and in all mining and other industrial works, as much, if not greater, safety than the black war, sporting, and blasting gunpowders of commerce. With this status of dynamite apparent, it was seen that the time had arrived for military men in the United States to begin experiments with it as a shell-explosive, with some possibility of success. When it was demonstrated that the freshly prepared crude commercial dynamite might be fired in a shell from an 8-inch gun with a charge of forty pounds of black gunpowder, the only question that then remained was as to the stability and reliability of the compound through age. And when, after sixteen months' storage, it appeared to be more sensitive to shock, the Ordnance Board recommended that no more experiments be made with it until it was further camphorated, or otherwise treated by competent chemists. And it was ascertained further, in these few and inexpensive tests, that the heat developed by the angular velocity was a more potent factor in detonating the dynamite than was the shock of discharge. It has been seen, also, that, since the comparatively recent discovery of nitro-glycerine, its development has been rapid in the protean forms of dynamite. In Europe experiments are being constantly conducted to perfect this agent, and doubtless they will succeed. Even now they claim in France and Germany to have perfected melinite and helphonite, — compounds probably of nitro-glycerine and some of the ethers. In Russia they also announce some new improvements that are not known here. But in the near future there is every probability that the problem will be solved in this country.

ELECTRICAL SCIENCE.

Electrical Testing-Laboratories in Paris and Vienna.

THE Société Internationale des Electriciens has completed and opened a laboratory whose main purpose will, for the present, be the testing and calibrating of electrical apparatus. M. de Nevville will be the director. The following measurements will be made: resistance, capacity, electro-motive force, constants of batteries, of cables and wires, insulation resistance, efficiency of dynamos (provisionally of continuous-current machines), and co-efficients of induction. When the means allow, purely scientific researches will be carried on. The laboratory is built on a modest scale, and seems to lack a few pieces of apparatus that will probably be supplied: for example, there is no provision for measuring mechanical work, — a measurement necessary in many cases for the tests of dynamos and motors.

The laboratory in Vienna is an addition to the Technological Museum in that city. Herr Carl Schlenk will superintend the work, which will include very much the same kind of tests as are to be made in the Paris laboratory.

The establishment of these two laboratories is important. The applications of electricity have rapidly advanced, and have assumed a permanent character. The questions in many cases are not, 'Can electricity do this?' but, 'How cheaply can it be done?' and this last question can only be answered by measurements. As competition increases, and as that part of the public looking for investment becomes less satisfied with the mere running of a machine, and demands accurate measurement of its performance, the necessity of some reliable means of comparing measuring-instruments becomes necessary. In England the Central Institution of London has undertaken the work; in Austria, the Technological Museum at Vienna; in France, the International Society of Electricians. Our country has outstripped all others in the applications of electricity. Probably we will soon have some means of comparing electrical apparatus, and testing the value of the numerous appliances daily patented. Electrical progress has been retarded and discredited by worthless patents in which a great deal of money has been invested and lost, while a simple test, taking little time and made at little expense, would have shown them valueless.

DUJARDIN'S METHOD OF FORMING SECONDARY-BATTERY PLATES. — Several methods have been tried, and some are now commercially used, of obtaining a quick formation of 'active material' — peroxide of lead and spongy lead — for secondary-battery plates. The Planté process of reversing the current is employed by some makers, while others deposit the peroxide and lead on support plates from an alkaline solution of litharge, as in the Moutard batteries. Dujardin's process of obtaining a deposit is as follows: the lead plates are put into a solution of sulphuric acid and sodium nitrate in water (10 of water, 2 of sulphuric acid, 1 of sodium or potassium nitrate), and a current is sent through the cell. By the passage of the current, nitrate of lead is formed, the lead being dissolved from the positive plate; and this is changed into sulphate of lead, and afterwards by the current into peroxide of lead. In a few hours the plate is covered with a layer of crystalline peroxide of lead. During the formation, air is forced through the cell, or the plates are lifted from the liquid at intervals. In the absence of data as to the performance of plates formed in this way, it is impossible to compare them with the ordinary 'grid' plates, pasted with red lead by the Faure process. The disadvantages of this last form have been pointed out in a previous number. The type of cell under which that of M. Dujardin comes — the 'Planté' form — generally offers the advantage of quicker discharge rate, and freedom from 'buckling,' as against the greater storage-capacity of the Faure type. How far M. Dujardin has remedied the difficulties of the type outside of the time necessary for formation, remains to be seen.

DISCUSSION OF ALTERNATING-CURRENT TRANSFORMERS. — The papers of Messrs. Kapp and Mackenzie before the English Society of Telegraph Engineers and Electricians have excited a great deal of interest and discussion on the subject of alternating currents. A number of people, many of them directly interested in electric lighting, have spoken on the matter. The majority of the speakers seemed in favor of the system, although it was attacked by Messrs. Gordon and Crompton, who prefer using storage-batteries for distribution. Arguments in favor of the alternating-current system were drawn from the experience of the Westinghouse Company in the States, that would be more weighty on this side of the ocean, if they were known to have been carefully verified. Some results of tests of the efficiency of transformers were given by Professor Ayrton, — the method of testing having been borrowed from our side of the water, — and values of 96 per cent were obtained under the most favorable conditions. As has been pointed out, however, in a former number of this journal, the transformers only work at the maximum efficiency for a short time during the day, so that the average efficiency will not probably be above 80 per cent. Various speakers favored different systems of distribution, but there were very few who had no experience to give; and the discussion was an interesting and instructive one.

BOOK-REVIEWS.

Transactions of the Association of American Physicians. Second session, held at Washington, D.C., June 2 and 3, 1887. Philadelphia, Assoc. Amer. Phys.

THE Transactions of the Association of American Physicians at their second annual meeting in Washington has been published. This association is without doubt the most representative body of the medical profession of the United States, having on its roll of membership the most prominent physicians of the country. The papers which are contained in this volume are of a very high order, and the discussions are exceedingly pointed and valuable.

The treatment of consumption by Bergeon's method, that is, by gaseous enemata, was the subject of three of the seventeen papers, the authors being Edward T. Bruen, M.D.; F. C. Shattuck, M.D., and Henry Jackson, M.D.; and William Pepper, M.D., LL.D., and J. P. C. Griffith, M.D.

Dr. Bruen sums up his views in these words: "I incline to think that suitable climatic environment is an all-important adjunct to the proper settlement of the value of Bergeon's treatment. But it is certainly an important addition to our therapeutic equipment to have an agent capable of influencing very markedly bronchial catarrh in so many cases, especially the 'stay-at-homes.' In a word, Bergeon's method, so far as I have used it, is chiefly valuable in those cases of pulmonary disease attended with bronchial catarrh. But I fear the trouble and detail necessary to its successful use will prevent many from employing the method, and I can easily see that the limitation of the power of Bergeon's method will cause it often to be set aside for other plans of treatment."

Drs. Shattuck and Jackson say, "This method is in no sense a specific for phthisis. If useful, it is only as auxiliary to older and generally accepted methods. The only benefit which we saw in our cases that can fairly be attributed to the enemata was diminution in the amount of the expectoration. The good effects which have unquestionably followed the treatment on this side of the water, as well as in France, are perhaps largely attributable to the stimulus afforded by a novel method of treatment, which is of such a nature that the patient cannot but feel that not only something, but much, is being done for him."

Drs. Pepper and Griffith conclude as follows: "Our conclusions, so far as they can be formulated in a preliminary report of comparatively few cases, are, that the treatment of phthisis by gaseous enemata has had very undue value attributed to it; that it is seldom of any real benefit, but that it may prove serviceable in occasional cases."

Dr. Henry Hun presented a paper on sewer-gas poisoning, with a history of twenty-nine cases. He concludes that it is probable that the following conditions may result from poisoning by sewer-gas: 1. Vomiting and purging, either separately or combined; 2. A form of nephritis; 3. General debility, in some cases of which the heart is especially involved; 4. Fever, which is frequently accompanied by chills; 5. Sore throat, which is frequently of a diphtheritic character; 6. Neuralgia; 7. Perhaps also myelitis of the anterior horns; 8. Zymotic diseases, such as typhoid-fever, pneumonia, diphtheria, cholera, dysentery, cerebro-spinal meningitis, erysipelas, and scarlet-fever (in these cases, undoubtedly, the sewer-gas merely acts as a vehicle for the specific germs); 9. A condition of asphyxia, which in its severe form is characterized by coma, convulsions, and collapse; 10. Puerperal fever; 11. Abscesses; 12. Lymphadenitis; 13. Acute aural catarrh (?).

The only other paper read at the meeting, which was of general interest, was one on methods of research in medical literature, by John S. Billings, M.D., U.S.A. This paper contains a good deal of excellent advice to physicians who desire to read up on any particular subject for the preparation of articles for publication or presentation to medical societies. Dr. Billings thinks that one of the most useful pieces of work which could now be undertaken for the benefit of medical writers and investigators would be the preparation of a dictionary of critical bibliography of medical bibliography, in which should be indicated for each subject, in alphabetical order, a reference to where the best bibliography relating to that subject can be found. This could only be well done by a co-operation of a number of writers, each taking a special field. This useful paper of Dr. Billings closes with a list of forty of the most useful reference-books, commencing with Albertus Haller's 'Bibliotheca Botanica' (1751), and ending with Richard Neale's 'First Appendix to the Medical Digest' (1886).

The other papers which were presented to the association were purely medical, and of little general interest.

Sewage Treatment, Purification and Utilization. A Practical Manual for the Use of Corporations, Local Boards, Medical Officers of Health, Inspectors of Nuisances, Chemists, Manufacturers, Riparian Owners, Engineers, and Rate-Payers. By J. W. SLATER, F.E.S. New York, Van Nostrand. 8°.

THIS octavo of 271 pages is one of the Specialists' Series, of which a number of treatises have already been issued, and of which several more are now in preparation. The title of the book before us is, we think, a little misleading. The reader expects from such a comprehensive title a good deal more than he actually finds when he reads the book. Still, the subjects which the author treats are handled in a very interesting and decidedly original manner, and, when the book has been read through, the reader is surprised that so much has been put into so small a space. Its perusal impresses one with the idea that Mr. Slater is a practical man, and that he writes of that which he knows from personal experience and observation, and not from a closet study of the books of others.

In his preface he refers to the unsettled state of the sewage question. Freezing and heating, concentration and dilution, electrization and magnetizing, the addition of oxidizers and deoxidizers, of ferments and preventives of fermentation recommended, if not actually tried, show the want of any distinct and generally recognized principle. This is still more forcibly illustrated by the fact that since 1846 there have been no less than 454 patents issued for the chemical treatment of sewage. In the space at our disposal it will be impossible to follow the author in detail; but there are some points which he brings out more clearly than any other writer with whose works we are familiar, and to those we desire to call attention.

In speaking of the London system, he pronounces it a failure. This system he calls Bazalgettism, from the distinguished engineer who has applied it to London. Its essential principle is to discharge either directly into an arm of the sea, or into a tidal river, at the time of ebb-tide. Sewage matters discharged into the river at Barking and Crossness are not pushed out to sea by the combined action of the ebbing tide and current, as was expected, but mingle with the water, and work their way back to points far above the outfalls, thus effecting that pollution which the intercepting sewers and the costly channels running parallel to the river were to have averted. Mr. Slater summarizes the matter as follows: "The Bazalgette process, as applied to London, is a total failure. It involves the utter waste of all the manurial matters in the sewage, it aids in silting up the bed of the Thames, it occasions a nuisance much complained of by the inhabitants of the country below the outfalls on both banks, its cost is exceedingly serious, and it does not even guarantee to the inhabitants of London an unpolluted river." It would be hard to conceive of a more vigorous and thorough condemnation than this which Mr. Slater applies to the sewerage system of London, and he is equally emphatic in reference to the proposed extension of the system to Thames Haven at an expense of $20,000,000.

The disposal of sewage by irrigation meets with no better treatment at his hands. He asks, "Does irrigation effect its object without occasioning annoyance or injury to the inhabitants of the district?" He has never failed to detect an unpleasant odor when passing near an irrigation-field in warm, still weather. At Gennevilliers, near Paris, the odor on calm, autumnal evenings may, without exaggeration, be described as abominable. Mr. Slater also believes that irrigation-fields may produce actual disease in their neighborhood, although he acknowledges that the evidence is somewhat conflicting. Irrigation does not remove germs, and it encourages flies, which act as carriers of these germs, it may be of cholera or typhoid-fever. On this danger from flies the author is very emphatic. He says that some of these insects that have become saturated with putrescent matter, or actual disease-germs, enter our houses and crawl over articles of food. Others settle upon our persons, and inflict malignant wounds. Fatal illness has not unfrequently been traced to the bite of flies which feed on sewage or carrion. These flies being now recognized as among the greatest agents for carrying putrid poisons and disease-germs to the healthy, it is important that all places where they can increase and multiply, and all matters upon which they may feed, should be made offensive to them or destroyed, as the case may admit.

These opinions are sustained by the experiments of Dr. Maddox, published in the *Journal of the Royal Microscopical Society*, by which it was demonstrated that the cholera bacillus can pass in a living state through the digestive organs of flies, and also by the experiment of Dr. Grassi, who showed that when segments of the tape-worm (*Taenia solium*) were placed in water, some of the eggs remained suspended therein, and that in the intestines and excrement of flies that drank of the fluid the eggs were subsequently found. Observations made by other experimenters are also confirmatory of the fact that insects act as carriers of germs and ova of parasites. Mr. Slater believes, too, that sewage-grass is very inferior to normal herbage, and quotes experiments made by Mr. Smee, and published by him in a work entitled 'Milk in Health and Disease,' by which it was proven that milk from cows fed on irrigation-grass became sour and underwent putrefaction much sooner than that from cows fed on grass from an ordinary meadow.

In concluding the discussion of irrigation, the author says that irrigation, though an excellent method of disposing of, and at the same time utilizing sewage, when suitable land is available, where the climate is warm, and the rainfall scanty or intermittent, is not applicable where these conditions are absent. Any attempt to represent it as the only means of dealing with the sewage difficulty, and to force it upon reluctant communities, is a grave error; in fact, a crime, the motives for which are in most cases hard to trace. The methods of sewage-disposal by filtration, precipitation, destruction, distillation, and freezing, are described, and their advantages and disadvantages pointed out.

The author, in concluding his treatise, devotes more than sixty pages to giving an abstract of the specifications of the 454 patents for the chemical treatment of sewage, occasionally adding a note pointing out what he considers to be their defects.

Letters of David Ricardo to Thomas Robert Malthus. Ed. by JAMES BONAR. Oxford, Clarendon Pr. 8°. $2.75.

THE letters in this collection were written between 1810 and 1823, the last of the series being dated only a few days before the writer's death. They are only in a minor degree personal, being mainly devoted to discussing the many questions in political economy on which Ricardo and Malthus disagreed. Unfortunately, the letters that Malthus wrote to Ricardo have never been found; so that we have only one side of the discussion, which is a drawback both to the interest and to the instructiveness of the correspondence. It is true that Ricardo often states his opponent's arguments; but such statements cannot supply the place of Malthus' own words. However, the letters will be very interesting to students of economics, illustrating as they do the views of two of the principal founders of the science. The men were personal friends, and were often in each other's company; but on economic themes they differed widely. They agreed in the main on the subjects of rent and population; but they disagreed on many matters of detail and on some of prime importance. Thus, they differed widely as to the definition of value, and as to the influence of supply and demand on the one hand, and of cost of production on the other, in determining value. They also differed as to the real nature of political economy; Malthus holding that it is an inquiry into the nature and causes of wealth, while Ricardo would confine it to the subject of distribution only (p. 175).

The two leading faults in Ricardo's published works appear with equal plainness in these letters. The first of these is his habit of fixing on one or two economic laws or forces, and tracing out their results without regard to the minor influences which often modify their action. He seems to have been aware himself of this tendency in his thinking; for he remarks in one of his letters that one of the chief causes of the differences between himself and Malthus was that he looked only to the larger and more permanent causes, while his opponent was always thinking of the minor ones. On this point, as on some others, it would have been well if the two friends had been content to learn from each other. The other defect in Ricardo's theories to which we have alluded is his constant assumption that wages are always at the starvation point, so that the slightest increase in the cost of living will necessitate a rise of wages in order that the supply of labor may be kept up. Thus, he argues that a tax on breadstuffs would lead to a rise in wages, and consequent fall in profits; whereas it might only result in reducing the standard of living among the laborers, so that the whole burden would fall upon them.

The friendship between the two correspondents, notwithstanding their difference of opinion, was of the warmest character, as is proved by many passages in these letters, and also by a remark made by Malthus after Ricardo's death, and quoted at the end of this volume. He said, "I never loved anybody out of my own family so much. Our interchange of opinions was so unreserved, and the object after which we were both inquiring was so entirely the truth and nothing else, that I cannot but think we sooner or later must have agreed." We should add, that the book is well edited, and that it contains much information, both in the text and in the notes, about Ricardo and Malthus themselves, and also about other political economists who lived in their time, so that it has a biographical as well as a scientific interest.

Lectures on Electricity. By GEORGE FORBES. London and New York, Longmans, Green, & Co. 12°. $1.50.

A NUMBER of popular works on electricity have been published in the last few years. Some are clearly written, some are interesting, very few are calculated to give correct ideas of the broad principles of the science of electricity.

There are six lectures in Professor Forbes's book, "intended for an intelligent audience, ignorant of electrical science, but anxious to obtain sufficient knowledge of the subject to be able to follow the progress now being made in the science." For its purpose the book is admirable. The simpler phenomena — if we may consider any phenomenon as simple — are clearly explained, and illustrated by experiments, sometimes new, always well arranged.

Lectures of this kind should have two objects, — to describe the phenomena, and state and explain the laws governing the science as fully as possible; and to give the audience an interest in the subject, and a curiosity that will lead to a further study of it. They should give an impulse toward thought, with some material for thinking on. So viewed, Professor Forbes has succeeded.

The first five lectures — on potential, electric currents, magnetism, electro-magnetism, and electro-magnetic induction — are extremely satisfactory: the last, on dynamo-electric machinery, would have been better omitted. It does not logically continue what has come before, nor is it, even considered apart from the other lectures, in any way as satisfactory as they are.

Taken as a whole, however, the lectures are to be commended for the clearness of exposition, accuracy of statement, and the very interesting way in which they are written.

NOTES AND NEWS.

A CYPRUS Exploration Fund has been formed in London, the object of which will be to carry on archæological researches similar to those of the Palestine Exploration Fund. The committee of this fund have applied to the high commissioner of Cyprus for permission to excavate in the island. This application was supported by a special resolution addressed to the secretary of state for the Colonies by the trustees of the British Museum. Permission has now been obtained in respect of one site, the village of Kouklia, which stands on the site of the ancient Paphos; and operations have begun there, on a large scale, which promise to yield results of exceptional interest, the special object in view being the great temple of Venus. The work is being carried out by students of the British School at Athens, under the supervision of the director, Mr. Ernest Gardner, whose services, and a contribution of £150, were placed at the disposal of the Cyprus Exploration Fund by the managing committee of the school. The same sum has been contributed respectively by the University of Cambridge (from the Worts Travelling Fund), the University of Oxford, and the Society for the Promotion of Hellenic Studies. Individual subscriptions amounting to upwards of £600 have been received.

— George S. Mackenzie, secretary of the Emin Pacha Relief Committee, publishes the following news, which was sent by mail from Zanzibar: "It is reported in the *Bazaar* here that Tippo-Tip, after some delay, has sent a number of his men to Mr. Stanley's camp on the Aruvimi." This news, which is published with some reserve, is very gratifying, as it shows the desire of Tippo-Tip to carry out the engagements he entered into with Stanley. The arrival of Tippo's party would enable Major Barttelot to despatch without delay the ammunition and reserve stores from the camp of Yambuga, at the mouth of the Aruvimi, to Wadelai. Although Stanley's progress was evidently not as rapid as was assumed in the plan, it is not necessary to entertain serious apprehensions as to the safety of his expedition. When it was stated that news of Stanley would probably reach us early in March, it was assumed that the steamers of the Kongo Association would visit the stations at Aruvimi and Stanley Falls. The steamer 'Stanley' was to be despatched to these places under the command of Captain van der Velde. Unfortunately this able officer died at Leopoldville a few weeks ago, his death being announced in the latest issue of the *Mouvement Géographique*. He explored the lower Obangi and its tributaries, the Itimbiri, and made an unsuccessful attempt to reach the Welle, starting near the most northern point of the great bend of the Kongo. His death has delayed the expedition to Stanley Falls, and for this reason it is assumed that the first news of Stanley will reach us *via* Zanzibar. As, however, communication between the Mvutan Nsige and the coast is very irregular, it is hard to tell when definite and reliable news will reach us.

— On Feb. 17 the first memorial erected to a public man in the Brighton Museum was unveiled there in the shape of a marble medallion portrait of the late distinguished scientist, Dr. Thomas Davidson, the first chairman of the museum committee, and whose lifelong study of brachiopoda won for him a foremost name in the ranks of paleontologists.

LETTERS TO THE EDITOR.

The Snow-Snake and the r-Sound.

THE evidence on the Southern use of the snow-snake is certainly not what was expected, and, with my experience of Indian traditions, is not satisfactory. Passing by this, I will mention two things noticed while on the reservation to-day. Many Seneca snow-snakes are now made there, and these differ from the Onondaga in being flat on the opposite surfaces, with the edges slightly rounded, A good crust being lacking, an enterprising Indian had made a gutter in the snow by the roadside, about fifty rods long, and was getting a little money by its use from a number of boys.

I looked up the name carefully. It had been written for me, as before stated, and I had somewhat hastily asked several its name when last there, without noticing any discrepancy. Now, it appeared that Mr. Hewitt was partially right; but every man, woman, and child gave it as *ka-when-tah*, or *ka-wen-tah*, changing the supposed *r* into *n* uniformly, and sometimes hardening the *k* into *g*. As I paid special attention to the second syllable, my own orthography stands corrected in this case, and that of Mr. Hewitt also. I also corrected one other word in which I made a similar error in some casual work.

In testing the version of the Lord's Prayer given me, a second time, the question is not so clear. I am not in the least troubled with *otosis*, and had used reasonable care, but without regard to the objection now made. The first three instances in which I then retained the letter may be called doubtful. I went over them again with my old friend Albert Cusick, and although the letter seemed there as the words were read, — and perhaps ordinary speech is the true test, — yet the sound almost disappeared when each syllable was taken by itself. In the fourth, where a clause was paraphrased rather than translated, there is less room for uncertainty. The sound is fuller, and is not readily dispensed with. But for its rarity elsewhere, I certainly should retain it there.

The last test I used was with the numerals given by Schoolcraft in his Onondaga vocabulary. He credits some words in it to the Mohawk. I do not remember that he does these, but they are not of the Onondaga language. In the first ten Onondaga numerals, *r* does not occur.

It is evident, of course, that Zeisberger incorporated many Mohawk words in his Onondaga lexicon, and his early study of that tongue perhaps sufficiently accounts for this; but how he could have spent the time he did at Onondaga, for the sole purpose of studying the language, and yet used this letter so much, and even in proper names, without its partial use by the central nation, is not easily understood.

One of the eminent authorities cited for the early disuse of the letter seems merely to quote from another, but some historical facts may have been overlooked. The Jesuit missions at Onondaga were abandoned late in the seventeenth century, though the missionaries sometimes came there very early in the eighteenth. In preparing a list of historic Onondagas, I took notice of a half-century of this *post-Jesuit* period. From 1725 to 1775. I found the names of fifty-seven Onondagas, and twenty-three of these contained the letter *r*. *Teyawarunte*, an Onondaga sachem, was speaker in 1775, as he had been long before. The year previous, the Onondaga sachems had a private audience with the new Indian agent, Col. Guy Johnson, and some of their distinguished men were presented to him. In the names of four out of the eight mentioned, is found the nominally obsolete letter. Here I leave the question.

W. M. BEAUCHAMP.

Baldwinsville, N.Y., March 8.

Needed — An Improved Means of attaching Microscopical Objectives.

THE recent interesting discussion in *Science* regarding the defects of existing microscopes ought to lead to practical results. While the subject is under consideration, every detail ought to be passed under review, or rather studied *de novo*, accepting no legacies of the past, no matter how useful they may have been in their day, provided we can find better devices. One very important thing to be considered is the means whereby objectives are to be attached to the tube of the microscope. Obviously, what we need for this purpose is a device so simple it can be easily manufactured and used, — one that is durable, and not liable to get out of order; which will fix the objective firmly in position, and yet will permit it to be attached or removed with the least possible expenditure of time and energy. It must be admitted that the screw meets all these requirements except in the important matter of attaching and removing the objective. The screw is not an expeditious mode of attachment, although it may be improved by lessening the number of the threads so that only one or two turns of the objective tube would be needed in order to bring it to position. Most objects require to be studied under different amplifications, and the time spent in changing from one to another is a real loss. Most working microscopists will begrudge every second spent in changing, not only because their time is valuable, but also because an object may thus be lost, at least for a time, especially if it is a moving object. If it is possible, objectives should be attachable and removable without having to draw back the tube of the microscope or disturb the object. This is accomplished by the revolving nose-piece, but under the disadvantage of being somewhat bulky; also it answers for only two or three powers, and leaves the unused objectives exposed to the dust. The Facility nose-piece, the Zentmayer cut-away nose-piece, etc., show that objectives can be attached more quickly than by the ordinary screw; yet, like the screw, these devices require drawing back the tube in order to be attached. It will be a great gain if some way can be devised whereby each objective can be easily and instantly slid into place from the side, the new objective pushing out the one in former use as it is itself pushed in. This would probably involve a square or rectangular plate fixed to the top of the objective, sliding in ways fixed to the instrument tube, or some other equivalent arrangement. It is not, however, my present purpose to discuss the ways and means for gaining the important end of attaching the objective by some more speedy device than the screw, only to call attention to the subject. If no device superior to the screw can be found, by all means, let the fittest survive. On the other hand, it is neither mechanical, nor in the end economical, to let the screw, because it is already in the field, stand in the way of a better device. At the present time both microscopists and manufacturers are agreed on the society screw, and those who prefer nose-pieces have to go to the expense of providing adapters. It will be no more than fair to change the programme. Suppose we agree on some standard form and size of nose-piece, and let those who prefer screws provide the adapters.

By having the nose-piece attached directly to the objective tube, we would do away with screws entirely, also all need of adapters except to tubes already provided with screws.

It may be objected that there are so many possible ways of attaching objectives, that there is no probability of coming to an agreement upon a single standard size and form of attachment whereby the objectives of all makers could be used on every microscope, as they are under the present arrangement of the society screw.

In reply it may be said that we cannot know this until after the attempt has been made. If American microscopists take concerted action for making their needs known, it must result in a great many suggestions as to the proper mechanical devices for securing the desired ends. The resources of mechanicians were not exhausted when the screw was invented. I believe it is only a question of time when the ordinary screw will be replaced by some more expeditious device, perhaps by some form of sliding collar, or, if the term be preferred, by the American nose-piece.

G. H. STONE.

Colorado Springs, Col., March 16.

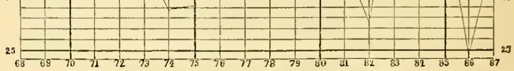
Is the Rainfall increasing on the Plains?

IN your issue of March 2, I observe the statement attributed to the chief signal officer, corroborating "the prevalent opinion that the rainfall in the West is increasing," while Mr. Henry Gannett "dismisses this popular idea as baseless." My own opinion is decidedly in favor of the affirmative of this question. My personal observations for twenty years at this point indicate the existence of a rainfall cycle of about seven years in duration, each septennial period including two or more consecutive years of precipitation above the average, and a similar series of years with precipitation below the average. A seven-year cycle is also illustrated in the Fort Leavenworth rainfall, whose records cover double the period of my own observations at Lawrence. Recognizing the existence of this cycle, it will require a minimum series of fourteen years of records to warrant a division of the period into two equal parts for the purpose of determining the question of an increase of rainfall. I would therefore eliminate from Mr. Gannett's list all but nine of the twenty-six stations. At these stations the aggregate increase of precipitation in the second half of the periods of observation is 109 inches, which gives an average annual increase of 1.28 inches for the nine stations. This is certainly a decided increase, although the average period of observation is only nineteen years.

But the length of the period of observation at Fort Leavenworth is thirty-nine (instead of twenty-eight, as given in Mr. Gannett's table), — from 1836 to 1874. A study of this series of observation is of great interest, since it is the largest series in our possession, and especially since its division into two equal parts throws the first half entirely into the period preceding the settlement of Kansas, while the second half is placed entirely within the period of settlement of this great Commonwealth. The total precipitation in the first half of this period (ending June 30, 1855) was 592.84 inches, giving an annual average of 30.40 inches, while in the second half (ending Dec. 31, 1874) it was 696.29 inches, giving an annual average of 35.70 inches. This shows a total increase of 103.45 inches, or an average annual increase of 5.30 inches. This is assuredly a change worthy of notice, involving an increased precipitation of more than seventeen per cent.

My figures concerning the Fort Leavenworth rainfall are derived from a transcript of the records furnished by Prof. Joseph Henry of the Smithsonian Institution, and published in the 'Annual Report of the Kansas Board of Agriculture for the Year 1874.' In this transcript there are no records for 19 of the 468 months of the 39 years. Five of these blanks occur in the first half of the period, and have been filled by inserting the average precipitation for the months in question. Twelve of the blanks occur in the second half of the period, and have been filled by inserting the actual rainfall for those months at Lawrence, Manhattan, and Fort Riley, all of which stations are within about one hundred miles of Fort Leavenworth, and have a smaller rainfall than that of Fort Leavenworth.

The following diagram is appended as exhibiting more clearly this periodicity according to my observations at Lawrence: —



ANNUAL RAINFALL AT LAWRENCE, KAN., 1868–87.

A similar platting of the Fort Leavenworth rainfall exhibits six periods of excessive precipitation, separated by intervals of seven years, and alternating with periods of deficient precipitation, in the same manner as in the above diagram of the Lawrence rainfall.

F. H. SNOW.

Lawrence, Kan., March 13.

Bacteriology in our Medical Schools.

IN connection with the subject of bacteriology in the schools, it should be stated that Johns Hopkins University, though it has not yet established a medical course, has organized a pathological institute. In this institute the subject of bacteriology is thoroughly taught in the most approved manner by a competent board of instructors.

H. W. CONN.

Middletown, Conn., March 21.

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American Architect and Building News.			
Imperial edition	10.00	12.80	11.00
Gelatine "	7.00	9.80	8.00
Regular "	6 00	8.80	7.00
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American Journal of Philology	3.00	6.25	4.25
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47 Lafayette Place,
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BOOK-NOTES.

— The Philadelphia Social Science Association will shortly publish a monograph by Prof. E. J. James, of the University of Pennsylvania, entitled 'Chairs of Pedagogics in our Colleges and Universities.'

— In the article entitled 'Where Shall We Spend Our Summer?' which Gen. A. W. Greely, chief signal officer, will contribute to the April *Scribner's*, he shows (as far as one can predict from the series of observations made by the Signal Service of the Army for many years) which will be the three hottest days of the coming summer, east of the Mississippi River.

— Messrs. Lee & Shepard, Boston, will soon publish the following books: 'Chips from a Teacher's Workshop; or, Educational Topics of the Day,' by L. R. Klemm, Ph.D.; and a new edition of 'Pre-Glacial Man and the Aryan Race,' which was first issued a few weeks ago, by Lorenzo Burge.

— The D. Lothrop Company announces the preparation and speedy publication of a series of graphic historical narrations by popular authors, telling the story of the States of the American Union from their earliest beginnings to the present day. 'The Story of the States' will be issued under the editorial supervision of Elbridge S. Brooks. Each volume will be fully illustrated with designs by L. J. Bridgman. The initial volumes will appear in the spring of 1888. New York, Ohio, and Louisiana are now nearly ready. The volumes already arranged are, 'The Story of California,' by Noah Brooks; 'The Story of Massachusetts,' by Edward Everett Hale; 'The Story of Virginia,' by Marion Harland; 'The Story of Louisiana,' by Maurice Thompson; 'The Story of New York,' by Elbridge S. Brooks; 'The Story of Ohio,' by Alexander Black; 'The Story of Missouri,' by Jessie Benton Fremont; 'The Story of Vermont,' by John Heaton; 'The Story of Texas,' by E. S. Nadal; 'The Story of Maryland,' by John R. Coryell; 'The Story of Colorado,' by Charles M. Skinner; 'The Story of Kentucky,' by Emma M. Connelly; 'The Story of the District of Columbia,' by Edmund Alton; 'The Story of Maine,' by Almon Gunnison; 'The Story of Pennsylvania,' by Olive Risley Seward; 'The Story of Connecticut,' by Sidney Luska.

— Mr. Kennan's Siberian papers, illustrated by Mr. G. A. Frost, who accompanied Mr. Kennan on his trip through Asiatic Russia, will begin in the May *Century*. Their appearance has been deferred on account of the author's desire to group in preliminary papers — the last of which will be in the April *Century* — an account of the conditions and events in Russia directly related to the exile system.

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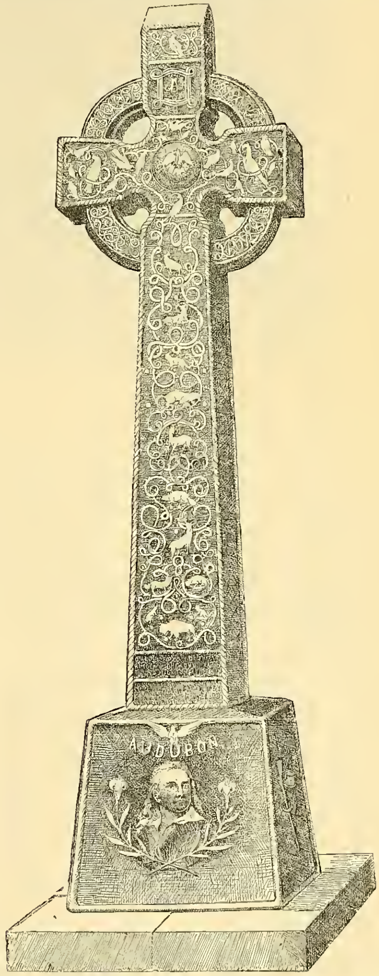
SCIENCE

FRIDAY, APRIL 6, 1888.

IF THE AUTHORS AND PUBLISHERS could remain in Washington for a month or two, and stir up the members of Congress about once a week by way of remembrance, we believe that the international copyright bill might be passed during the present session. During the week they were there, they found friends on every side, some of them unexpected ones. The fact that all interests have been harmonized; that even the representatives of labor, whom the politicians are more afraid of than any other class of people who go to Washington with 'demands,' are satisfied, — has made a very marked impression upon Congress. We hear from Washington that the bill is very likely to pass the Senate before the adjournment, and to be reported favorably from the judiciary committee of the House. It is doubtful if the latter body, already pretty deep in the mazes of political legislation, and in less than two weeks to be wrestling with the tariff bill, and annual appropriations, and a hundred and one other topics, will have any time to devote to this measure of simple justice. The principal trouble with the international copyright bill is that there is no politics in it.

MR. G. E. GOODFELLOW'S REPORT upon the epicentral region of the Sonora earthquake, published elsewhere in this issue of *Science*, is the first connected or at all complete description of it that has yet been received in the United States. Some fragmentary and disconnected accounts by the Mexican scientific commissioners had been forwarded to the government through the State Department, but these were so meagre and disjointed as to be of very little value, except as supplementary to Mr. Goodfellow's report. The latter, prepared as it was by a gentleman who makes no pretensions to scientific expertness, is considered at the United States Geological Survey Office as a very remarkable and creditable performance. It is rare that a report is received at that office from any source, which gives evidence of so systematic, conscientious, and thorough investigation, of such perfect freedom from preconceived ideas or theories, and in which the results of an inquiry are given with so much succinctness and intelligence. Mr. Goodfellow has received many compliments at the Geological Survey Office for his excellent piece of scientific work.

THE committees in charge of the memorial to Audubon have selected a design, and are now actively engaged in endeavoring to raise the necessary funds. The committee of the New York Academy of Sciences are associated with committees of the Torrey Botanical Club, the Natural History Association of Staten Island, the Audubon Society, the American Ornithological Union, the Linnæan Society of New York, and the Manhattan Chapter of the Agassiz Association. They have so far received only a small amount of contributions, and are anxious to have the matter completed, so as to have the unveiling of the monument take place in the early fall, if possible. The design for the monument is shown in the annexed cut. It consists of a runic cross of North River bluestone, which will be eighteen feet high above the base, mounted on a pedestal which will be six feet in height. The cross will be covered on both sides with designs of the birds and animals which Audubon described, the selections being made by a special committee of the joint committees appointed for the purpose. The base will have upon one side a bas-relief of Audubon, surrounded by the Florida water-lily, which he discovered and described. On one side will be his rifle and game-bag, he being one of the most expert shots of his time. The other face will be filled by a suitable inscription to his memory. The monument is to be placed in Trinity Cemetery, at the foot of Audubon Avenue, and will be one of the most beautiful monuments in any cemetery in New York. The effect of the relief and carving upon the North River bluestone is

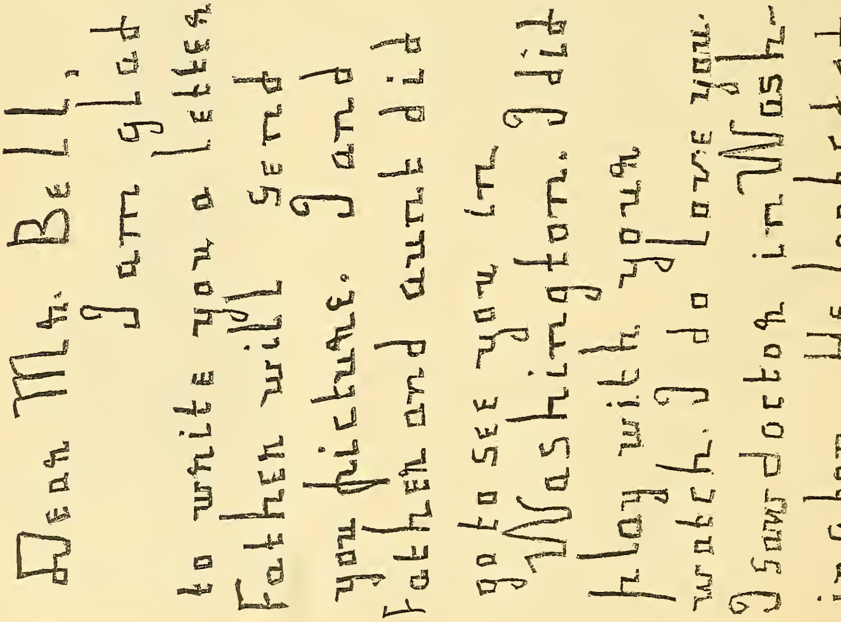


such as to bring out the design, and at the same time give exactly the same effect as the ornamentation of the old runic crosses. The monument itself will cost ten thousand dollars. This does not include the erection of the vault, and the exchange of the new plot for the old one, which has been kindly undertaken by the corporation of Trinity Church. Subscriptions may be sent to Dr. Britton, Columbia College.

HELEN KELLER.

IN *Science* of Feb. 24 we gave an account of Helen Keller, a second Laura Bridgman, who, although blind and deaf, is making wonderful advances in her education. This week we give her portrait and that of her teacher, Miss Annie Sullivan, a graduate of the Perkins Institute at Boston, and also reproduce in facsimile a letter written by Helen Keller to A. Graham Bell of Washington. It was only in March, 1887, that Miss Sullivan was engaged to give the first instruction to her pupil, who was then six years old. In a month the little girl learned to spell about four hundred words, and in less than three months could write a letter unaided by any one. In six weeks she mastered the Braillé (French) system, which is a cipher for the blind, enabling them to read what they have written. She has also mastered addition, multiplication, subtraction, and geography. The illustration shows the method in which all this information has been transmitted, — solely through the sense of touch.

HELEN KELLER AND HER TEACHER, MISS ANNIE SULLIVAN.



Dear Mr. Bell,
I am glad
to write you a letter.
Father will send
you picture. I and
father and aunt did
go to see you in
Washington. I did
play with your
watch. I do love you.
I saw doctor in Wash-
ington. He looked at

my eyes. I can read
stories in my book.
I can write and spell
and count. good girl.
My sister can walk
and run. We do have
fun with Jumbo.
Prince is not good dog.
He can not get birds.
Rat did kill baby
pigeons. I am sorry.
Rat does not know
wrong. I and mother
and teacher will go
to Boston in June.
I will see little blind
girls. Nancy will
go with me. She is.
a good doll. Father
will buy me lovely
new watch. Cousin
Anna gave me a pretty
doll. Her name is Allie.
Good-by
Helen Keller.

SCIENTIFIC NEWS IN WASHINGTON.

Mr. Goodfellow's Report: the Locus of the *Temblor;* Description of the Great Fault; Damage to Towns; the Shaking-up of the Mountains; Fixing the Epicentral Area; Indications of Two or More Impulses; the Direction of the Wave; the Time. — Distortion in Plane-Table Sheets.

The Sonora Earthquake.

MR. GEORGE E. GOODFELLOW of Tombstone, Arizona, has just sent to Capt. C. E. Dutton, of the United States Geological Survey, a carefully prepared report on the earthquake which occurred May 3, 1887, in the south-western part of the United States and in the northern portion of Mexico. His observations were made during two journeys to the centre of disturbance in Sonora. Very little was learned by the first journey, principally because the time was wasted in searching for an alleged active volcano which had been graphically described by an imaginative correspondent of the New York *Herald,* but which never existed.

In a second trip, Mr. Goodfellow met Prof. José G. Aguileria, of the Mexican Exploring Commission, which was engaged in making a similar investigation. An arrangement was made with him by Mr. Goodfellow to exchange information; but, as he had received no report from Professor Aguileria as late as March 5 of the present year, his report is based almost exclusively upon his own observations.

After having explained why it was absolutely impossible to ascertain the time of the first shock in and about the epicentral area, and some other important data, on account of the absence of time-pieces, the illiteracy of the people and their indisposition to give facts if they had them, the sparse population and inaccessibility of the country, the absence of all means of rapid communication or transit, and, last but not least, the unparalleled severity of the rainy season of 1887, Mr. Goodfellow says, —

"The seismic movements of May 3, 1887, were felt from Toluca, capital of the State of Mexico, 26 leagues south-west from the City of Mexico, to Albuquerque or Santa Fé on the north, and from Yuma and Guaymas on the west, to a point about 60 miles east of El Paso on the east. . . . A central tract of maximum intensity, owing to superficial manifestations of ruinous energy, can be located with a considerable degree of certainty, and may be placed in the San Bernardino valley, and probably a contiguous portion of the Teras Mountains.

"The valley of the San Bernardino is a typical south-western one. It takes its name from an alleged stream, which rises near the border, in the United States, and, flowing southwards, empties into the Yaqui. These south-western valleys may be divided into three parts, — the narrow bed of the water-course; the alluvial overflow bottom; and the mesas, including the foot-hills of the encompassing mountains, for one merges into the other so rapidly, it is hard to tell where the dividing-line may be. Confining my description to the central seismic region, — the Cordilleras of Mexico, — the Sierra Madres, wherein it lies, may be said to have a general north-and-south course. The main chain is composed of numerous short ranges having a trend of 20° north or 30° west. Between each of these ranges is a pass with commonly an easterly and westerly direction, usually carrying more or less water. The valleys before described have the north-and-south direction of the bordering mountains. These mountains, varying in altitude from four thousand to ten thousand feet, are composed, for the most part, of tertiary metamorphic and eruptive rocks. In the range east of the Fronteras valley, and also east of the San Bernardino, are paleozoic strata, presumably carboniferous. The mesas are made up of more or less closely aggregated drift from the mountains. The depth of this detritus may be gauged by a description of some mesas in the neighborhood of Babispe. Between Babispe and the Madera Mountains is a mesa several miles in length which is completely isolated. The level of the river at Babispe is about 2,950 feet; and this mesa rises to the height of 4,500 feet, 1,500 feet above the altitude of the river, and is composed entirely of coarse drift. This is shown in many places by channels of lateral erosion.

"The water-courses display the usual phenomena of south-western streams, water appearing in occasional places throughout the entire length of the bed, but a great quantity from a few inches to a few feet beneath the surface. On the eastern margin of the San Bernardino valley, where mesas merge into foot-hills, close to the steeper part of the mountains; on the mesas and in the water-courses of the valley, — are located the evidences of the severity of the earthquake. These consist of a single large fault and many minor fissures and downthrows. The former is on the base of the mountains; the latter, on the mesas and in the immediate beds of the streams. The large fault begins at the northern end of the valley, a few miles south of the line, in what is called Elias Creek, a tributary of the San Bernardino. It commences very gradually on the southern bank of the stream, increasing in width as it makes a curve towards the cañon of Los Embudos, from which point to its end the general direction of the fissure is north and south. It has a winding course, following the tortuous line of the base of the ranges in all its sinuosities to and across the Yaqui River, into the Teras Mountains some miles. Its total length, as far as followed, is about thirty-five miles." In a private letter to Captain Dutton, Mr. Goodfellow says, "In a note to *Science,* I stated that the fault was one hundred miles in length. This was a great error." He then explains that there are no good maps of Sonora and Chihuahua, save one, and that one he had not seen at the time. He was therefore obliged to judge of the length of the fissure by the time it took him to travel, and by very uncertain Mexican reports of distances. "The average difference of level between the two sides is a little over seven feet. In some places, as opposite Pitaicachi, the difference is much greater. In its entirety north of the Yaqui, it conforms to the usual law of faults by having the hanging wall the lowest; but, after passing that river some two miles, there is a place for a short distance, some two or three hundred yards, where the hanging wall is the highest. The difference in level of the portion south of the river is about three feet. At the point mentioned, where the hanging wall is elevated, the variation is a trifle more.

"The first question rising in the mind, after viewing the fissure, is, 'Is it an ideal fault, or the mere changing of the drift of the mesas by reason of alteration in subterranean reservoirs of the valley?' As favoring the first view, is the fact that it lies so near to the base of the mountains its entire length. With the structure of the valleys, before described, did it lie out on the mesas away from the foot of the Sierras, the conclusion would be almost irresistible that it is nothing more than a slip of alluvial drift, as the river-bed downthrows undoubtedly are. But, by examining closely its *locale* and characteristics, there seems a preponderance of evidence favoring the first opinion. Still there is this one thing to be recorded: nowhere in its path, as far as I saw it, can be seen an instance of the solid rock showing a participation in the fissuring, except at Pitaicachi, where a dike may be seen in the breast of the slip. This, I think, is more apparent than real. There are but three places that I saw along the line where such rents could show. These are, first, a small cañon a short distance north of Pitaicachi; second, a cañon in the Cabellera Mountains; next, at the Yaqui River. In all of these places is running water, which would have been sufficient to destroy evidence of petrous rupture. In the upper cañon, which I will call 'Elisu,' the fissure passes some three hundred feet to the west, and below a stratified mass of shaly rock which rises abruptly at this point. The approaches to these cañons are very steep; the walls at the locus mentioned being on the southern side almost vertical, on the other at an angle of at least 45°. The causes, then, of partial non-appearance of the crack on the sides of the cañon are self-evident, — the inclination is too great. In every one of the other arroyos and cañons crossed by the fissure, the bottom had as great a rent as the surface of the mesa above, and the walls were depressed proportionately to their inclination. In the Cabellera Cañon the fault is somewhat closer to the rocks, but, aside from this, the other manifestations are the same. I have no doubt that in both, at the time of the first disturbance, the alteration of level in their beds was equal to that on each side above, but the stream soon filled and levelled them. That this is the true solution of the problem, I have had ample evidence in other arroyos usually dry. In these, succeeding the rains and consequent temporary torrential flow, the break was rapidly evened, and was no more visible than in the places mentioned. At San

Rafael, where it crosses the Yaqui, the explanation is not so easy. Approaching the river from the north, until within less than a mile, the average drop is maintained. There, however, it gradually diminishes until within about three hundred feet of the stream, where it becomes simply a crack in the bluff which leads to the river-bank. On the opposite side it recommences as gradually, but never attains the old width, not exceeding in any place over five feet, and gently lessening, until at the point I abandoned it, nearly five miles south of the river, the difference in level is a foot or less. On this southern portion may be noticed two facts, — first, the course is more directly into the mountains; no longer hugging their base, it strikes directly for their heart: next, and perhaps not the least important, is the phenomenon of the hanging-wall elevation instead of depression. At the place I left off following it, a division into two occurred, the split taking place at the foot of a moderately high hill of reddish-looking metamorphic rock. Whether the fissure extends farther to the south, I cannot of my own knowledge say. From some intelligent prospectors that went into the Teras Mountains afterwards, attracted by the idea that such terrestrial commotion ought to develop some leads of mineral, and whom I asked to note any peculiarities observed, I learned that it does extend about fifteen miles more to the south. From the diminutive size of the fault where I last saw it, this seems to me improbable. It certainly is not impossible, and the statement may be taken *sub judice*. One thing is assured: the Teras Mountains have been wofully broken up; this I personally know. I have been told by Colonel Kosterlitzky, who has recently been there, that on the Chihuahua side of the Espuelas and Pitaicachi, is a duplicate of the San Bernardino fault. I have endeavored to confirm this, but without success.

"When I first viewed the end on the northern side of the river at San Rafael, it seemed certain that there was the termination of the rupture; and it was not until one of my Mexican escorts had crossed the stream, and hunted in the thick brush, that it was discovered leading up the hill. The explanation of the diminution at this place to a mere crack on each side of the river is not entirely plain to my mind: therefore I leave the problem to you for solution. The rock is indubitably involved in the slip at this point, although the drift prevents it from being seen. If it was not, there could be no faulting of even an inch, for it is not loose mesa drift, simply a slight covering with the results of cliff denudation. The solid rock shows close on both sides of the fault.

"The pass through the mountains, where the Yaqui reverses its course, is a very narrow one, three or four miles in length. The walls are perpendicular on each side, rising to the height of several hundred feet, and are composed, as are the immediate hills on the north and the mountains on the south, of some reddish-gray looking rock, probably eruptive. At the point where the river debouches from the pass, and on the last bluff on the north, the fault passes through its centre, becoming a mere crack. The pass is, or was then, impassable, though some of the Mexicans with me said they had gone through it when the river was very low: at all other times it is impossible to penetrate the gorge.

"Some things to be noticed about the fault, in connection with its sinuous course, are the small fissures at each bend with any great degree of angularity. These occur on the salients of each angle, but have no great length, in no place extending over a few hundred yards, except opposite the Cabellera Mountains, where there is a triplicate division over a mile in length. This gives the main fault the appearance of having been compressed lineally from the south, most of them having the free end to the north. They are mostly ground-throws, not simply cracks.

"From Pitaicachi to Cabellera Cañon the fault is far up on the immediate foot-hills, and subsequently crosses them where there can be no doubt as to a petrous substructure at slight depth. But, as all of them are more or less extensively covered with *débris*, I saw no spot in the face of the fault where a rent of solid rock was visible. Neither did I follow it closely through this section, owing to the weather when there. Thus I missed exploring the locality of all others which might have illustrated the point at issue. No one, however, who might stand and look over the ground at that section could doubt, that, even if nowhere else there was slipping of solid rock, here certainly there must be. A point which attracted my attention, and which seemed significant, was the appearance of the foot-wall of the slip in many places, particularly where it abutted closely on the mountains. This was the polished surface, as if the same place had been the seat of similar perturbations in the past. At these points the drift appeared to be more thoroughly consolidated than at other localities. This striation and polishing began within a few inches of the upper margin of the wall, — a place where one would think slipping of the loosely aggregated mesa drift would cause such an appearance. In addition, the fault at these places usually was backed a short distance by the more durable portion of the mountains, generally a bluff of some extent from fifty feet to one hundred yards away. In no part of the line of greatest drop is the fall less than eight feet, while in many places it exceeds twenty. The estimated altitude of the mountains is, Guadaloupes, Espuelas, and Cabelleras, about 7,000 feet; the Teras, 9,000 to 10,000.

"This, then, is a description of the big fault. We will now consider the river-bed cracks and downthrows, for they come next in size. Beginning about the San Bernardino Ranch, at the line, these lesions exist as far as Granadas, which was as far south as I went. These ruptures are not continuous. This form is most marked about Batepito and Babispe. It is safe to say that the bed of every water-course in the San Bernardino valley has changed level relative to the mesa from six inches to two feet. This has nothing to do with the alteration of height as connected with, or caused by, the great fault: that is additional. These river-bottom dislocations seem to be a breaking-away of the bed from the enclosing mesa. The mesas composed of drift are from twenty to one hundred and fifty feet in height above the alluvial bottom, averaging perhaps fifty. The cracks begin at or within a few feet of the base of these terraces, and their course is that of the river-bed. The extent of these from San Bernardino in a direct line I have told. They also run from Bacerac to below San Miguelito, on the upper portion of the Yaqui, but are lost sight of at that point. Whether this be due to a total absence, or to the fact that the trail leads away from the river, I cannot tell; but from a short distance below San Miguel, to a crossing called 'Pedregoso,' I saw none, at such points as we struck the river in the line of the trail. These fords, however, were at places where the nature of the channel would have prevented any such phenomena, it being rocky and narrow. The Fronteras valley, east of the San Bernardino, but tributary to it, as may be seen by the water-course, was severely cracked up in the same manner, but in a degree not to be compared with the two first named.

"In addition to these cracks and dislocations in the valleys named, were lesions of another kind, — outbursts of sand and water through fissures and small crater-like holes, a few inches to a foot or more in diameter. This phenomenon was experienced in the Sulphur Spring and San Pedro valleys in the United States to a considerable extent, but not with the severity found farther south. At Batepito Ranch, an area two miles long by one wide was four or more inches deep with water immediately succeeding the first shock on May 3. This was the greatest quantity of water thrown up at any one place; but the total amount must have been very great, as the craters are met with wherever the river-cracks exist, and sometimes where they do not.

"The next class of fissures are simple cracks without depression existing on the mesas. None of them are, as naturally would be the case, through solid rock. They are many and extensive on the mesas of the San Bernardino valley, and have a general direction towards the main fault. Their width varies from an inch to a foot or two, usually under a foot.

"Next of the surface phenomena to be considered is the line of devastation in the mountains. Here we find millions of cubic feet of rock thrown down from the mountains to the cañons and water-courses below. Cliffs of solid crystalline rock are shattered and split, as if a charge of giant-powder had been lodged carefully amongst them for the express purpose of annihilating them. The magnitude of the quake can be appreciated more by the evidences of its force in the mountains than by the fault. The fault has the appearance, and gives the idea, that it could not be helped: it simply sunk, as Topsy growed. But the rending and splitting of such masses as the mountain-cliffs impress one with a profound idea and respect for the forces at work. This line of devastation will again be referred to.

"Of the towns most damaged, the principal one was Babispe. This typical little Mexican town lies on the west bank of the Yaqui or 'Babispe' River, as it is there called. The old town is situated on a terrace of the larger mesa, where the new town is. This lower mesa is about thirty feet above the river-level, and about sixty feet below the surface of the upper mesa. The composition of the mesa is, as previously indicated, loosely aggregated drift from the mountains. At this place the superficial deposit is very imperfectly consolidated. Back of the town, to the west, is the Madera range of mountains, a branch of the Teras. The range is directly to the west, and it cannot be over three or four miles away. So far as the method of Mallet in noting angles of emergence, etc., is concerned, I have this to say: there is not the slightest doubt that Mr. Mallet, or one equally as expert, could have succeeded with it, for there were plenty of fissured walls and overturned objects on which to work. There were all angles of emergence in one building, — cracks ranging from ten degrees to vertical, with several diverging branches. It seems to me that all that can be gathered out of the chaotic state of affairs is, that there has been a considerable shake-up. Apparently the buildings are very substantial, being constructed of adobes 24 × 12. These are laid double, which makes all walls 24 inches in width. The average height is 8 to 10 feet; only one in the town having been greater, and that was 22 feet. The roofs are made by laying rafters, or 'vigas' as they are called, from one wall to the other; then covering these with cane, ocotilla, or brush, and that with mud, to a thickness of at least six inches. This makes an extremely heavy roof, but certainly the most suitable one for the climate. Above the vigas is built a slight coping, or fire-wall; and at intervals are openings with wooden troughs to permit the passage of rain-water. The remains of the building with the four corner posts standing are those of an exceptionally built one; and a very lucky exception it was in this case, for it saved the lives of four persons who were in it at the time.

"Of the dwellings destroyed, the major portion were on the northern and eastern side of the plaza. All walls facing the plaza on its west side whose linear direction was north and south were thrown down, falling toward the east. These were from eight to twenty feet in width, averaging probably ten feet. Of the houses on the south side of the plaza, which lie at the junction of the terrace on which the town is, with the foot of the mesa above, none were seriously damaged. They were more or less cracked, but were not prostrated. The church is the most conspicuous monument of the devastating energy of the *temblor*. It was not, perhaps, as substantial a structure as some of our slighter but more modern civilized buildings, but it certainly could lay claim to the dignity of having withstood the storms and prayers of at least two centuries.

"The destruction of life was, in my opinion, largely due to the style of architecture. The walls were not held together. In some instances I found the north-and-south walls had separated and let the vigas down into the house on one side. This involved motion of at least a foot. The walls two feet thick, viga laid to cover the entire width was obliged to slip that distance before it could drop. The horizontal cracks at the base of the walls indicated the motion. All damage was done by the first shock. The effect of subsequent tremors was visible only by psychological manifestations. Almost without exception, both sexes gave way to their terror, and devoted themselves to religious exercises for the purpose of propitiating the wrath of — so the priest said — a justly offended Deity.

"Opotu was the next town of any size to suffer considerable injury. This place lies south-west of Babispe, on the Yaqui River. It is situated on a bluff of alluvial drift on the bank of the river, some fifty feet above the stream. The axes of the two are pretty much the same as those of Babispe, almost north, south, east, and west; the population a trifle greater. There were nine people killed outright, and several others injured. I think the intensity of the shock here was fully as great as in Babispe; but the buildings did not possess the age of those in the latter place, none in Opotu being much over twenty-five years old, while none in Babispe were less than one hundred or two hundred. Perhaps this made less difference than at first sight seems possible. Owing to the manner of construction, a certain amount of repairs are constantly necessitated, which would, of course, tend to render them more stable. Of the walls thrown down, with two or three exceptions, all fell to the westward, though the upper portion of a few of the east-and-west walls had toppled over towards the south. Walls over twelve feet in length, with their linear axis east and west, suffered entirely in the east and west corners. Where they were shorter, they were thrown down, falling indifferently north or south. The characteristic damage received by all houses not prostrated was in the corners.

"In Fronteras several buildings were destroyed, and one child killed. Fronteras is just off the overflow bottom of the little stream which goes by the name of the 'Fronteras River.' The river is about three-quarters of a mile to the east of the village, and nearly on the same level. A portion of the pueblo is on an isolated drift mesa thirty to fifty feet higher than the remainder. On this mesa is where most of the damage was done. It is not over one hundred feet wide at any portion of it occupied by the houses, consequently presents facilities for amplitude of wave-motion not possessed by the lower town. The Fronteras valley is many miles in width, mesas included, and the alluvial part of it is thoroughly water-soaked. The river-bed skirts rather closely the ranges of mountains on the eastern side of the valley. The buildings of Fronteras are of great age, — one to two hundred years. San Bernardino Ranch may be considered as on the same isoseismal. Here were two buildings of adobe, presumably substantial, though slighter than the Mexican-built structures. Both were instantly prostrated at the time of the first shock, fortunately injuring no one.

"The foregoing makes up the pueblo line of maximum intensity. I wish now again to consider what I have ventured to name the mountain circle of worst disturbance, or the interior line of maximum intensity. The line of demarcation is as distinct as a street in a city. In the order in which I saw them, would be, first, the one on the trail to Babispe, south of Bedregoso. This is from one hundred to three hundred yards in width: it is difficult to tell, as the route is through a deep, narrow cañon, but through there the shattering of the rocks has been extensive. Tons have fallen into the cañons from the cliffs above. Before reaching that point, the disturbance has been moderate, and, after passing, the country has the same appearance. The next place passed having the look of equal dynamic energy was far to the south, on the range between Bacadehuachi and Granadas, about halfway, probably a trifle nearer the latter. Here identical phenomena were exhibited, — a narrow line where rocks, shaly and crystalline, have been terribly broken up. . . . On the trail from Opotu to Fronteras, between Nacosart and the Yaqui, and a little more than halfway from Fronteras to Batepito, similar phenomena were seen.

"The preceding localities form an isoseismal which I have called as above. Let me relate some of the objective symptoms which have determined my opinion in this matter. In the course of my journey, in spite of the condition of Batepito, I came to the conclusion that the epicentral area was in the Teras Mountains. The principal reason I had for this was the character of phenomena hourly occurring. During all the time I was circling that region, those mountains were continually the seat of various seismic manifestations. The principal of those was the rumbling, roaring, or, as it seemed to me, the groaning of those massive peaks. Usually this would be succeeded by a more or less severe shock; but many times the noise would be heard, lasting a minute or more, but no tremor followed. While I was in the neighborhood, certainly, all seismic disturbances had their origin from those mountains, irrespective of my situation. I had rigged up a seismograph, if such a contrivance can be entitled to the name, consisting of a bullet suspended in a large beer-bottle. This, with moderate accuracy, gave me the direction of the vibrations, and all seemed to come from the northern end of the Teras Mountains. Connecting these interior mountain-points, and erecting perpendiculars, the mean epicentrum is thrown south of the San Bernardino valley. If the Babispe, Opotu, Fronteras, and San Bernardino Ranch are joined, and the same plan pursued, the upper end begins about Pitaicachi, and the lower somewhere near the other mean.

"Admitting that the central region is about the north end of the Teras, and the southern portion of the San Bernardino valley, the peculiarity which attracted my attention was apparently the two circles of maximum intensity, — the mountain-line, and the one indicated by the destroyed and injured towns. The solution is for you. But the thought has obtruded itself in my mind, why cannot there be areas of re-enforcement in earth as in water waves, where a succession of small impulses are followed by an aggregated one? This by reflection and accumulation of successive shocks from the focus. Of course, the point could be placed on the isoseismal of the towns, or considered as areas of characteristic epicentral disturbance.

Noteworthy is the immunity of Bacerac and San Miguel; the former nine miles south, the latter three and one-half miles to the north, of Babispe. Though the energy of the shock was undoubtedly great, no serious damage was inflicted, save to the feelings of the inhabitants; and the degree of religious frenzy originated, more than compensated for the lack of seismic perturbations. They can be put on the isoseismal of Tombstone.

"Of the effects of the *temblor*, none have been of greater interest or more importance than the modification of the water-supply of the shaken district. During the first shock, all over the area of severe and even moderate vibration, the phenomena of water-craters were exhibited. This, however, was merely a temporary affair, the flow ceasing as soon as the violent shaking was over. It is the permanent re arrangement of the water-distribution which we have to consider. Many apocryphal stories have been told of the wonderful increase of water in the Yaqui and other streams immediately succeeding the earthquake. In addition to the outpouring of the crater water, many springs were made. This latter effect was not, however, an instantaneous one. In most of the rivers and springs where there has been increase, at first they went almost dry; then in a few days or weeks was a gradual augmentation of water, this antedating the rainy season. At the present time there is an alteration in the water-supply, with others, of the following streams and springs: the rivers of Fronteras, Yaqui, and San Bernardino; the springs of Penuelas and several others with uncertain names; the arroyos of the passes, Elias, Elisu, and Cabellera. Most important is the Yaqui River. This gradually gained in volume after the first diminution, until the flow equalled its midwinter amount. The San Bernardino is now flowing from head to mouth, a thing never before known at this season of the year, and is said to be gaining. Several important springs on the eastern side of the mountains, opposite Babispe in Chihuahua, were increased in size, notably Penuelas on the Carretas Ranch. A number of entirely new springs were started. In fact, over the entire central seismic region, the water-supply has visibly augmented. In considering this, the effect of an unusually severe rainy season must be estimated.

"The rainy season of 1887 has been unequalled since 1881. There was, however, an unquestioned gain of water before this set in. But when it did come, there was nothing by which one could judge whether a specified enlarged flow was due to rain or *temblor*. The summer rainfall has been added to greatly by an extraordinary winter downpour. Altogether, there has been sufficient celestial increment to throw considerable doubt on the proximate origin of the terranean and subterranean surplus. Unlike the treasury surplus, there is no need of reduction. It is required. By reason of this extraordinary quantity of aerial moisture, the estimate of the value of the quake to the country must be held as subject to modifications in the future, should a dry season supervene, and demonstrate that the abundance of water was due to the heavens, not to the earth. One cannot contemplate the San Bernardino valley without believing that such stupendous changes as are there manifest must have caused some permanent alteration in the subterranean reservoir, — either increment or decrement. And if, at the lapse of a year, a decided increase is noted, as has been, the former result must be concluded to have taken place.

"It will be noted in all reports that the direction of the first shock is given as from west to east. This, perforce, in most instances can be nought but error, especially on the line of the railroads from Guaymas north. But let us consider the case of the Sulphur Spring valley. At the time of the primary quake a cattle round-up was going on at the station called Abbott's Ranch. The house is near the centre of the valley, which is here nearly thirty miles wide, and thoroughly waterlogged. There is no running stream; but over its entire area water exists, from a few feet in depth on the margin, to but a few inches in the centre, which is full of swampy holes. It is a mass of alluvium, neither the mesas nor the bordering ranges on the west or east encroaching much on the margins. All reports from this place (and I have interviewed at least thirty of the one hundred or less men present when the first shock occurred) say it came from the west. The explanation I have to advance for this may or may not be a tenable one. It is this: in all earthquakes, near the central region there is what may be called a 'resonant area' preceding the vibratory movements of the earth. This, in the *temblor* of May 3, antedated the onset of the tremors a sufficiently long time to have passed to the west and north-west at the instant the shake began. Of course, the noise being in the west, the origin of the simultaneous terranean movements was of necessity located there. This, however, does not entirely answer for the Sulphur Spring valley. There they claim to have seen the rocks falling and the dust rising on the western side of the valley first, and some seconds later the same phenomena on the eastern. I am inclined to think that this is to a certain extent true. My reasons are the character and continuity of the mountain-ranges extending from the western side of the epicentral area to the western portion of the valley, and the nature of the valley itself. The rate of vibration and wave-propagation must have been modified by passing through so saturated and heterogeneous a mass as the latter. The mountains are not actually continuous between the points mentioned, but there is less breaking, therefore slighter apparent chance of interruption, on that line than any other; and it seems not an improbable or impossible hypothesis to assume that the waves, both of sound and of movement, were propagated along that line most rapidly, and did reach the western side of the valley anterior to the time they made their appearance in the east. If this be not the solution of such united testimony, it must be solved in some other way. I think the time-data indicate this view of it, though in this you must be the judge.

"Among other *sequellæ*, the mountain-fires which the effects of the earthquake were the sole factors in originating, were due to two causes, — falling bowlders and the emission of ignited gases. The Sierra Madre fires were, beyond question, synchronous, and arose similarly. The evidences of gaseous irruption were few but striking. Primarily were the statements of many who claim to have seen streaks of flame at different points, in the course of the first night in particular, and several times thereafter during succeeding days and nights while the heavy shocks continued. This evidence might have been a subjective sensation purely, due to inherent mendacity, or phenomena of fright similar to the stellar exhibition of syncope. The objective testimony cannot, I believe, be gainsaid. The shifting of such a tremendous mass of earth must have had some concomitant phenomena; and, if water and gas shot out to varying but moderate altitudes, why should not ignited gas do the same? It did; and the evidence was found in several places, both in the river-beds and in the hills along the line of faulting. This consisted of cinders about the margins and on the walls of the river-fissures, and the discovery of burnt branches overhanging the edges of such places, as well as the same testimony on some of the hills and mountains near the main fault.

"Anywhere near one hundred and fifty miles of the centre the energy of the shocks was considerable. All along the Sonora Railroad, from Guaymas to Nogales, and from the latter place to Benson, Tucson, El Paso, and as far north as Albuquerque, general alarm was excited. From Charleston to Benson, in the San Pedro valley, was a section of quite violent and terrifying motion. Water-tanks slopped over, cars were set in motion on the track, chimneys thrown down, buildings cracked, and water spouted up from the ground. The last-mentioned phenomenon was not exhibited north of Fairbanks. The track sank and bent at a point where it runs in an east-and-west course, about two miles west of Fairbanks. The convexity of the bend was south. These villages and stations are in the narrow, alluvial bottom of the river-course.

"At Batepito are some old adobe houses. They were frail and in ruins many years anterior to the earthquake, but it is remarkable that the remaining walls were not prostrated by the shock. Of course, some of the upper portion was broken off, and one or two having roofs crumbled in. Such structures in Babispe, Opotu, Fronteras, or San Bernardino, would have been demolished. These houses stand in the centre of the section mentioned as having been covered with water several inches deep, and which has sunk over four feet.

"Tombstone being the nearest place where a number of time-observations could be compared, it becomes requisite to know with as great exactitude as possible the instant the shock arrived. At the onset of the *temblor* I had just noted the time, and my watch was partially in my hand in the act of returning it to my pocket. When I looked, it was 2.48 mining time, which was that day thirty-five minutes faster than standard or railroad time. When, recognizing the nature of the phenomena occurring, I again looked at my watch, just one and three-quarters minutes had elapsed. This was after the tremors had passed. The noise, resembling artillery-firing more than any thing else, continued for some seconds, dying slowly away in the north, to return in a few seconds from the south. By careful comparison and consideration of at least thirty different statements as to the Tombstone time, I am compelled to put the onset at 2.13, with a possible and probable error of ten or fifteen seconds. From Guaymas to Benson I have made personal inquiries, and think there is room for more error than in the Tombstone time. The difference in Sonora time and standard was that day thirty-four minutes.

"As concisely as possible I have tried to convey to you the facts as seen by myself, and ventured some crude notions based upon my interpretation of the observed phenomena. My idea of the explanation of the opinion that the shocks came from the west is not altogether theory. I have had the good or bad fortune to have witnessed and felt a large number of mild and severe *temblors* the past year; and if the judgment of a non-expert, based upon personal experience, be worth consideration, then the assumption is not valueless, and is worthy of your investigation."

Mr. Goodfellow's report is accompanied by maps and photographs, references to which are omitted here, as have also been some few brief passages not essential to a comprehension of the facts.

Distortion in Plane-Table Sheets.

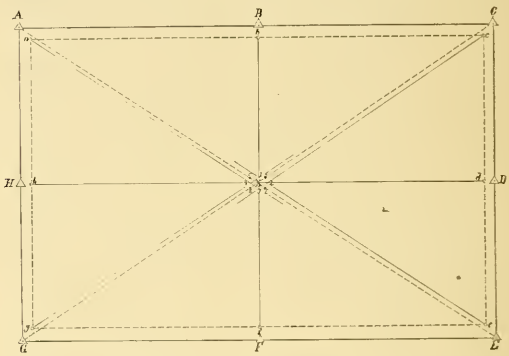
Mr. H. G. Ogden presented to the Philosophical Society, March 17, some observations on the effects produced in a plane-table sheet by its absorption of moisture. It is well known that wetting a sheet of paper causes it to swell or expand, and that, when the sheet has dried again, it has returned to about its original dimensions. Mechanical draughtsmen have realized the errors liable to occur in their work from this cause, and have effected a partial remedy by shrinking the paper upon a board, and securing the edges to prevent further contraction, and then to provide against expansion by working in a reasonably dry air. Surveyors using the plane table resort to the same devices when executing work of great refinement, especially if they have not the check afforded by the positions of a triangulation previously plotted on the sheet. But even with a well-conditioned triangulation, unless the paper is glued to the board, the contraction is frequently the cause of great annoyance, and sometimes of error.

When a sheet of paper expands from moisture, the percentage of increase in length is less in the direction of the grain of the paper than at right angles to that direction, or across the grain, and the difference between these percentages is practically the distortion. If the percentage of increase should be the same in both directions, there would be only a change of scale: all distances would be proportionally increased, and the points would bear the same relations to each other as before the expansion.

While it is true that the primary cause of the distortion is the absorption of moisture, the resultant effect is usually a permanent contraction, subject only to slight changes, except under the condition of excessive moisture. It is while this point of permanent contraction is being reached that the greatest annoyance is experienced and the most serious errors are likely to occur. Mr. Ogden then described a series of experiments made at the Coast Survey office some years ago, to ascertain the changes in length that took place in the hand-made antiquarian paper backed with muslin. Inspection of these observations, when plotted in the form of a curve, shows that there was a decided tendency to assume a state of permanent contraction. The readings at this point for each cross-section are 35 and 26 d. c. m., or at the rate of a little over .5 d. c. m. per inch of paper in one case, and .4 d. c. m. in the other. The difference between these rates is the average distortion in this case, — a quantity that is quite appreciable in a foot of paper, and very plainly so in two feet. In field-work, Mr. Ogden said that he had frequently found the distortion double this amount, and in one instance he remembered it nearly three times as large. He had also worked a whole season without any appreciable development of distortion.

In charts or maps printed from copperplates, or by any process that required wetting the paper, this distortion is largely developed, usually averaging as great as one per cent, and, if inferior paper has been used, as much as two or three per cent. The fact that this distortion exists is frequently not realized even by the most expert navigators, and some even magnify the errors by laying off courses with a protractor, discarding the compass-cards printed with the chart. These compass-cards are affected by the contraction exactly as the sheet is: directions ascertained by them are perfectly good, but the graphic angle between any two directions is erroneous, except in the case where the directions are on the lines of contraction.

Mr. Ogden then referred to a diagram, a copy of which is given herewith. *A*, *B*, *C*, etc., were plotted in the true relations. After



the sheet has contracted, *a*, *b*, *c*, etc., represent the relations those points have assumed. The paper contracts at a uniform rate in each direction.

The table is supposed to be at *X*, the exact centre of the figure, and it is required to determine the position by the distorted points *a*, *b*, *c*, etc. By reversing the telescope, we immediately ascertain that we are directly on the line *HD*. It will also show that we are on the lines *AE*, *CG*, and *BF*. But the distortion is not apparent until the telescope is pointed at the signals, and the lines are drawn on the sheet. Then if we orient by the line *HD*, we shall produce the figure of the diagram, giving five determinations, 1, 2, 3, 4, and *X*, each made with four well-conditioned points. Any one of these positions would be considered satisfactory if we had not the other points to show that something was wrong. To orient by the lines *BF* will produce the same result. But if we take the diagonal *AE*, we shall have two positions at 5 and 7, formed by the intersection of the diagonal points, with the lines from the other points running wild. Using the diagonal *CG* would give two points at 6 and 8, with the lines at the other points running wild, as before.

There is no question, that, out of the nine positions developed by these settings, that at *X* is the only true compromise. When the sheet is distorted, all positions are compromises; and *X* is the true compromise in this case, for it is on the lines *GC*, *AE*, etc.: *a* being below, and *e* above, the line connecting *A* and *E*, by equal quantities, a line drawn between the distorted points *a* and *e* must pass through the middle point *X*. The positions 5, 6, 7, and 8 cannot be true, because the lines forming them will not pass through the opposite points when extended, which we know to be conditions that must be filled.

The plane table is essentially a direction instrument. Theoretically we can do perfect work without knowing a single distance, and afterwards, by measuring some length between objects marked on the sheet, determine a scale for the whole. This being the case, the angle at the occupied station, between two points marked on the sheet, will be the same wherever the points may happen to be on the paper. It is the practical application of the geometric functions of similar triangles. But the distortion of a sheet destroys these perfect proportions, for we have to preserve directions between fixed objects, and knowingly increase or diminish the angle contained between the directions. As at *X*, we know that it is in its proper position on the line between *ae*, *cg*, etc.; but we know also that the angle *aXh* is smaller than it is in nature, and the angle *aXc* is larger.

This forcing the position does not produce any appreciable error in the work represented, as in short distances, like filling in detail around the station, the distortion cannot be measured, and in long distances it can be eliminated. It is evident that a station made by three points on the lines of contraction will give the table the true orientation, for the effect of the distortion upon three points so situated is only that of a change of scale, and a change of scale does not affect orientation. But the position of the station made in relation to the other points on the table is not true, owing to the change of scale not being the same on both lines of contraction. From the conditions presented, Mr. Ogden deduced the following rules: —

(1) A station made with three points that are on the lines of contraction, the resecting lines forming nearly right angles at their intersection, will give the true position in relation to all points on the sheet (as *h*, *b*, and *d*).

(2) A similar condition of right-angular intersection at the station, but the lines forming diagonals to the lines of contraction, will give the worst possible position for the station (as *a*, *c*, and *e*).

(3) A station made with three points on one of the lines of contraction will give the correct orientation of the table (as *a*, *h*, and *g*).

(4) In estimating errors of the points due to distortion, those situated on the lines of contraction require no allowance, however distant.

Mr. Ogden then explained the treatment in cases where only three points were visible, — first, when all of them are on the lines of contraction; second, when two of them are on the lines of contraction, and one of them not; and, third, when neither of them is on the lines of contraction.

The effects of distortion, as Mr. Ogden explains them, throws some light on the relative accuracy of plane-table triangulation. This class of work is good and reliable if the paper does not change its conditions; but it is evident that a triangulation extended over a sheet that has contracted since the base was plotted on it, and the first few triangles laid down upon it, will be continued on varying scales. We have but to conceive the triangles extended in the form of a parallelogram, working two sides of it from each of the separate bases to a common point, to see the theoretical outcome of such conditions.

Plane-table triangulation is liable to be further complicated by frequent changes of scale or different degrees of contraction as the work progresses, which prevent the possibility of computing the resultant errors. Some check can be obtained by subdividing the sheet into squares of uniform size, which will show, at least, how much the paper has changed when the work is finished. Such squares are an assistance in the information they give while the work is in progress; and by carefully watching the changes in them it would be possible to apply corrections for the points of a plane-table triangulation that would eliminate the worst of the errors incident to such work.

The uniformity in the contraction of a sheet of paper may also be taken advantage of in measuring the length of a diagonal line by drawing lines on the lines of contraction at right angles with each other; and, having obtained the true lengths of the two sides of the triangle, the third may be computed with at least as much accuracy as it could have been measured on the paper if the scale had not become distorted.

ELECTRICAL SCIENCE.

Alternating versus Continuous Current Distribution.

THE subject which most engrosses the attention of electric-lighting people at present, is the question of the relative values of continuous and alternating currents for electrical distribution. In England the matter was brought up by the papers of Messrs. Kapp and Mackenzie on transformers, while in this country a pamphlet issued by the Edison Company, attacking the alternating system, has been followed by two interesting papers read before the Chicago Electric Club, — one by Mr. Leonard in favor of the continuous, the other by Mr. Slatterly favoring the alternating system.

The difficulty in all of this material is that it is distinctly partisan. In spite of this, it is valuable. The trouble, of course, in getting reliable data on the subject, lies in the fact that those who have had most experience of the practical difficulties or advantages of a system are those who are directly interested in its working, and who must have some bias in its favor.

In the discussion before the Chicago Electric Club, Mr. Leonard, taking the matter up first, considers the following points: first cost, economy, reliability, value of possible sources of revenue, safety, effect on existing property. Under the first head he calculates the cost per lamp of the copper necessary for conductors in the direct system at different distances from the station: for example, with an average loss of eight per cent in the conductors, and a distance of six thousand feet, the cost is $3.87 per lamp. With this he compares the cost of the corresponding investment in the alternating system, — copper and transformers, — and makes it $4. This is on the assumption that copper is sixteen cents per pound. As it is principally in the cost of conductors that the alternating claims advantage over the direct system, Mr. Leonard's figures would go to prove the advantage of the latter for mean distances up to six thousand feet from the station. Passing to depreciation of the distributing plant, Mr. Leonard claims that the conductors in the direct will depreciate in value less than the conductors and converters of the rival system. The reliability of the direct system would seem greater than that of the other; for the apparatus is less complicated, and a breakdown of one engine or dynamo in a station will not affect the lights. The possible sources of revenue seem to Mr. Leonard more numerous in the continuous system. At present the alternating system can supply only light and — if it is ever needed — heat: its rival can be utilized for all the purposes to which electricity can be applied. The danger of high potential alternating currents is dwelt upon, and fatal results were cited.

Mr. Slatterly, in replying to the paper, disputes some of Mr. Leonard's points. The estimates, based on sixteen cents per pound for copper, would hardly apply to copper at nearly twenty-five cents, its present price. The alternating system has the advantage that it can be used at *any* distance from the station, and the latter can be built on inexpensive ground, not in the middle of a crowded district where property is costly. Mr. Slatterly claims for the alternating system that the accidents that have happened are due to inexperience, and their occurrence was not a fault of the system. On the question of danger he states that alternating currents are not so dangerous as continuous currents of the same potential. As regards distribution of power, Mr. Slatterly thinks that an alternating electro-motor will soon be forthcoming.

In considering electrical questions with a view of deciding between two systems, we should consider two things, — economy under present conditions, and the probable progress in the near future. As things stand at present, we may say that the direct system has the disadvantages of a limited area of distribution, and the necessity of locating in a central position, where land is expensive: the alternating system has the disadvantage of a considerably greater loss in distribution, of greater complexity and consequent liability to accident, impossibility of distributing power, and danger. These considerations would point to the direct system being best in the central portions of cities, while the alternating system should be used for towns and for the suburbs of cities; possibly, too, as an auxiliary to arc-lighting stations.

In the future the alternating system can hope for the perfection of a motor and the general improvement of the apparatus: the direct system can hope, besides the ordinary improvements, for the perfection of some converter for direct currents; above all, for storage-batteries. If storage-batteries are successfully developed, the alternating system has nothing to offer that the direct system does not possess, while the advantages of the latter will be overwhelming. As we have already pointed out, however, a combination of the two systems would undoubtedly be best at the present moment.

ELECTRIC MOTORS FOR MINING-WORK. — Some contracts have just been completed by the Sprague Electric Motor Company that are being watched with interest by mine-owners. The most important order is for motors to be used on a circuit of about eighteen miles in length, for pumping, hoisting, etc. The river whose bed it is desired to work for gold, curves in a horseshoe shape; and a tunnel has been cut across the narrow part of the shoe, diverting the river from its bed. A turbine in the tunnel drives the generating-dynamo, while the motors are distributed along the bed of the river. Some of the other contracts are for running hoisting apparatus by motors, the power being obtained from streams distant two or three miles. There is no application of electricity with a wider field than the distribution of power, and nowhere can power be more successfully distributed by electricity than in mining-work.

FARBARKY AND SCHENCK ACCUMULATORS. — Among the numerous modifications of the Faure-Sellon-Volckmar accumulators, one of the most successful is the battery designed by Farbarky and Schenck. Originally the usual 'grid' form of support plate was used, the improvement consisting in mixing coke or other porous substance with the active material to give a better circulation of the electrolyte in the plate. Recently a change has been made in the shape of the holes in which the active material is contained. With the square hole completely filled with peroxide, there is no allowance made for its slow expansion, and the result is the 'growing' of the positive plate, with, under certain conditions, a falling-out of the plugs. In the new Farbarky-Schenck plate the solid bars are circular in form, intersecting, and leaving between the larger openings smaller, narrow slits, that allow the peroxide in the main openings to expand without causing more than a slight local strain. While it seems possible that this form of plate is an improvement on the ordinary type, yet it is hard to believe that plates made by pasting red lead or litharge into holes in lead frames can form the final type of storage-cell. In England, Germany, Austria, and this country, the Faure plan of using salts of lead mechanically applied to the support is almost universally used. In France, on the other hand, some modification of the Planté plate is usually employed, the endeavor being to form active coatings on the lead supports by the employment of an electric current, either forming the peroxide from the material of the support, or depositing it from the solution employed. At present the Faure plan is most generally used, but it is probable that the final lead storage-cell will be made by some modification of the Planté system.

THE SCHANSCHEIFF PRIMARY BATTERY. — This battery has zinc and carbon electrodes in a solution of basic sulphate of mercury and bisulphate of mercury in water. The cell has been tested by Sir W. Thomson, Mr. Preece, and others, and has been highly commended by them. The liquid can be quickly renewed when exhausted; the expense is not great; and for certain classes of work, such as mine-lamps, the lighting of trains, etc., it is said to possess advantages in weight and economy over secondary batteries.

BOOK-REVIEWS.

The Long White Mountain; or, A Journey in Manchuria. By H. E. M. JAMES. London and New York, Longmans, Green, & Co. 8°. $6.

WE have reported several times on the interesting journey of Messrs. James, Younghusband, and Fulford in the south-eastern portions of Manchuria. A full account of this journey has now been published. The special value of the book lies in the full and concise description of the history, the inhabitants, and the religion of the province, and particularly its administration, produce, and trade. In the southern provinces the Chinese form of administration has now almost entirely superseded the Manchu, while in the province of Kirin both Chinese civil officials and Manchu military commandants are found. In the northern provinces, where Chinese immigrants are not so numerous as in southern Manchuria, the Manchu military officers still bear sway. In the region of the Long White Mountain no officials of any kind are found, but the inhabitants have formed themselves into guilds, — a very effective means of keeping their district free from brigands, which infest almost the whole province of Manchuria. The towns and villages are protected from their ravages by walls. In discussing the taxation, the author mentions the general corruption of the authorities, and gives his opinion on the opium trade. He shows that opium is grown in many parts of Manchuria, even close by the highways, although its cultivation is prohibited by law. Therefore he thinks that the raid upon the Indian opium trade is out of place, as China can supply her want of opium herself. This chapter of the book is one of the best, as the author, who is a member of the Civil Service of India, has evidently a thorough knowledge of the trade and commerce and of the production of eastern Asia. In the description of his travels, which occupies the second half of the book, particular attention is paid to the produce of each part of the province, to the methods and facilities of trade, and to the dues collected from it. He describes the roads, which are for the most part practicable only in winter, when the swamps and bogs are frozen. Even the military roads are in a poor condition. The most interesting part of the journey was that in the Ch'ang-pai-shan, the Long White Mountain, which was known from descriptions of Chinese travellers and the Jesuits, who visited it in the beginning of last century. The mountains were said to attain a height of twelve thousand feet or more, but the measurements of Younghusband show that it is only eight thousand feet high. The sources of all important rivers of Manchuria are situated in these mountains; and it must be regretted that the travellers, on account of a scarcity of supplies, were unable to make a more accurate survey of this region. The description of the inhabitants, who have formed a small republic of their own, is very interesting. We described some of the observations made by the travellers in this region in No. 245 of *Science*, according to a lecture delivered by James before the Royal Geographical Society. In the present volume he details his experiences more fully, and his report is full of interesting facts. After leaving the Long White Mountain, the travellers turned northward, and visited Tsitsihar and many other places, their travels practically covering the whole region east of the line from the Gulf of Liao-Tung to Tsitsihar. The book, which is accompanied by a good map and numerous illustrations, forms a very valuable contribution to our knowledge of the present state of affairs in Manchuria, the author giving a vivid picture of all he has seen and heard during his interesting journey.

A Manual of Analytical Chemistry, Qualitative and Quantitative, Inorganic and Organic. By JOHN MUTER. 3d ed. Philadelphia, Blakiston. $2.

THE object of this work has been to produce a manual, short and easily understood, taking the student from the simplest to the most complex matters of qualitative analysis, and also dealing with quantitative work sufficiently to give him a fair insight into all branches of this department. It is adapted for students who desire to prepare for pharmaceutical, medical, or general university examinations in practical chemistry. The present edition has been considerably condensed in bulk, though a large amount of additional matter has been introduced. Muter's analytical chemistry has always been a popular manual with teachers and students, and the improvements in this edition will make it still more acceptable.

The Urine. Memoranda, Chemical and Microscopical, for Laboratory Use. By J. W. HOLLAND. Philadelphia, Blakiston. 12°. 50 cents.

THIS manual deserves to be generally adopted in medical schools and by physicians. It contains the latest and best tests, and is well illustrated. In addition to the tests recommended, which are both chemical and microscopical, Dr. Holland gives, under the heading 'Import,' the bearing which the result of these tests has upon the diagnosis and treatment of the patient. For instance, after describing the various tests which may be employed for the detection of urea, he says, "As urea is highly soluble, it is never spontaneously deposited. It varies in amount with different diseased conditions: e.g., in febrile and inflammatory affections it is increased in the forming stage, and diminished in that of defervesence; in diabetes mellitus and simplex it is excessive in the urine; while in acute yellow atrophy of the liver it may be entirely absent. In acute and chronic Bright's disease there may be a decided falling-off from the healthy proportion, causing a lower specific gravity. In such cases there is more or less danger of uræmia." These clinical notes are well and concisely written, and increase the value of a book which is in all other respects excellent.

NOTES AND NEWS.

DR. EMIL BESSELS, the eminent Arctic explorer, died suddenly on Saturday, March 31, at Stuttgart. His death was reported here on Monday, but not confirmed until Wednesday. He was well known to American scientists, as he lived in Washington after his return from the 'Polaris' expedition, of which he was a member. He died while in his native country, where he was about to publish a number of works.

— The incessant endeavors of the Providence Franklin Society to organize a geographical survey of the State of Rhode Island have at last been successful. The Legislature of that State has voted a sum of five thousand dollars for a topographical survey, and appointed a commission of three to contract for and superintend the work. Prof. Winslow Upton, Mr. Mills, and David W. Hoyt were appointed commissioners.

— Th. Macfarlane, in the third 'Bulletin of the Laboratory of the Inland Revenue Department of Canada,' comments upon the adulteration of coffee in Canada. Among eighty-five samples collected in various cities of Canada, only forty-four, or fifty-two per cent, were genuine, while the rest were to a greater or less extent mixed with chiccory and roasted grain and peas. Among the samples occurred some described as "chiefly roasted grain with chiccory and a little coffee." As these samples were bought by revenue officers, it is probable that in reality the percentage of adulterated coffee is still greater than the above figures indicate.

— Dr. Götz Martius of the University of Bonn publishes a lecture upon the aims and results of experimental psychology, in which he makes a high claim for the admittance of this science to an acknowledged place upon the curriculum of every university. The immediate occasion of the address was to arouse an interest in this line of research among the members of the university at Bonn, and to urge the establishment of a laboratory where Professor Lipps, the well-known psychologist, and himself, can have the opportunity of contributing to the advance of this growing science. There are several indications that the leading educational institutions of this country will advocate a similar department in the near future.

— The Imperial Observatory of Rio de Janeiro plans the publication of a universal dictionary of climatology. For this purpose, the director, Mr. L. Cruls, has prepared and sent out a circular soliciting information from all official and private sources as to the climatic elements of places at which observations have been or are being carried on. A table is attached to the circular, in which the results of observations are to be inserted. The mean temperatures of the months of the year, the mean maxima and minima, humidity, days and amount of precipitation, cloudiness, frequency of gales, days of frost, prevailing winds, the absolute maxima and minima, the mean annual barometric pressure, and the mean annual oscillation of the latter, are the points on which information is solicited.

— Last summer Prof. B. W. Evermann of the State Normal School, Terre Haute, and Prof. O. P. Jenkins of De Pauw University, spent their vacation at Guyamas, Mex., on the Gulf of California, collecting fishes. They packed their specimens and shipped them for home, but they did not arrive until recently, having been lost somewhere. Professors Evermann and Jenkins will arrange the collection this summer, and prepare the results of their work for publication.

— In *Science* for March 9, p. 119, 1st column, 5th line from bottom, for 'homogeneous' read 'homonymous,' for 'image' read 'images,' and for 'it' read 'they.'

LETTERS TO THE EDITOR.

Dr. Edward Tyson and the Doctrine of Descent.

ONE of the things most strongly emphasized by the recent publication of Charles Darwin's letters is his conscientious recognition of the claims of others to the first discovery of either the law of descent with variation or the principle of natural selection. The pains he took to prefix to the later editions of his work on the origin of species an historical sketch, is evidence of his earnest desire to do full justice to all previous explorers in his field. He, however, did not consider it incumbent on him to look beyond the narrow circle of those who had distinctly and explicitly expounded a doctrine of derivation. Nevertheless, for the future historian of scientific belief, the mere foreshadowings and beginnings of the modern idea of the origin of species, which Darwin set upon a firm basis of inductive proof, cannot but have an enduring interest and importance.

In this view of the matter, I feel that I may perhaps claim space in your journal to call attention to the work and writings of a man who does not seem to have been mentioned heretofore in connection with this subject, but who undoubtedly had at least a vague presentiment of the coming theory of the descent of man, derived from anatomical investigations, which, even at the present time, would probably be regarded as skilful and exact. I refer to Dr. Edward Tyson, fellow of the Royal Society and of the College of Physicians, and otherwise distinguished in his day as a man of learning and ability, who published, in 1699, his treatise entitled '*Orang-Outang, sive Homo Sylvestris; or the Anatomy of a Pygmie compared with that of a Monkey, an Ape, and a Man.*'

It is pleasing to observe in this book not only the carefulness with which Dr. Tyson traced the differences and resemblances between the parts and organs of the little monkey brought to him from Africa and the homologous parts in the higher primates, particularly man, but also the ingenuity and insight with which he drew inferences, which, if freed from the repressing influences of the seventeenth century, we can hardly doubt would have extended to the clear discernment and acceptance of the general law of development. The details of his anatomical comparisons there is not room for here; but some of his theoretical views may, I think, be referred to without exceeding proper limits.

In the first place, he seems to have perceived, though dimly, the main basis of evolution; for, amongst other similar reflections, he says, "I find there are intermediate *Species* of *Beings* between *Vegetables* and *Animals*, as the *Zoophyta*; the *History* of which I could extreamly desire might be given us; and cant but think that regularly in compiling a *History* of *Animals*, one should commence from them; and amongst these, no doubt, but that there are several degrees of Perfection, till we come to what might be properly called an *Animal*." And in another place, with still more particularity, he tells us, "Tis a true Remark, which we cannot make without Admiration; That from Minerals to Plants; from Plants to Animals; and from Animals to Men; the Transition is so gradual, that there appears a very great Similitude, as well between the meanest Plant, and some Minerals; as between the lowest Rank of Men, and the highest kind of Animals. The Animal of which I have given the Anatomy, coming nearest to Mankind; seems the Nexus of the Animal and Rational."

As if it were not enough to thus skirt along the edge of the doctrine of derivation, our author appears to have actually had a prophetic eye upon the great leader in the scientific renaissance of the nineteenth century, when he exclaims that "it would be the Perfection of Natural History, could it be attained, to enumerate and remark all the different *Species*, and their *Gradual Perfections* from one to another." And with the same irresistible impulse which Darwin possessed, to philosophize as well as observe, he further on explains with reference to his own comparative survey of his pygmy with a monkey, an ape, and a man, that, "by viewing the same Parts of all these together, we may the better observe *Nature's Gradation* in the Formation of *Animal* Bodies, and the Transitions made from one to another."

It is interesting to observe, also, that Dr. Tyson not only anticipated, in a measure, the methods and conclusions of the Darwinian period, but even, in some cases, made use of the very terms and phrases which we have come to associate with that period alone. Thus he declares "that in this *Chain* of the *Creation*, as an intermediate Link between an *Ape* and a *Man*," he would place his pygmy. Elsewhere, however, he cautiously explains that his pygmy "is no *Man*, nor yet the *Common Ape;* but a sort of *Animal* between both; and tho' a *Biped*, yet of the *Quadrumanus-kind;* tho' some *Men* too, have been observed to use their *Feet* like *Hands*, as I have seen several." In another place he gives it as his opinion that "we may safely conclude, that *Nature* intended it a *Biped*," though he apparently feels bound to add the qualification, "yet I still think it but a sort of *Ape* and a meer *Brute*." In fact, all through his comparison he is careful to aver, that, while "our Pygmie more resembles a *Man* than *Apes* and *Monkeys* do . . . where it differs, there 'tis like the *Ape-kind*."

In the summary of the results of his dissections and comparisons, he gives tables of the particulars in which "the Orang-Outang, or Pygmie, more resembled a Man, than Apes and Monkeys do," and of those in which "the Orang-Outang, or Pygmie, differ'd from a Man, and resembled more the Ape and Monkey-kind." The points of resemblance to man he enumerates as forty-eight, and the points of difference as thirty-four. It is a curious fact that some of his points of similarity are the very ones that Darwin has made prominent by the attention which he has given to them. For example: Dr. Tyson refers to the form of the ears, in regard to which he says, "None could more resemble those of a *Man* than our Pygmie's; both as to the largeness, colour, shape, and structure. Here I observed the *Helix*, *Ant-Helix*, *Concha*, *Alvearium*, *Tragus*, *Anti-Tragus*, and *Lobus*." Like Darwin, too, he traces the rudimentary tail, of which he remarks, "The *Os Coccygis* had but four *Bones*, and these not perforated, as tis in *Man;* In *Monkeys* there are more *Bones*, and they are perforated." Darwin attaches importance to the fact "that the hair on our arms tends to converge from above and below to a point at the elbow." Dr. Tyson notices the same peculiarity, of which he remarks, "The tendency of the Hair of all the Body was downwards; but only from the Wrists to the Elbow 'twas upwards; so that at the Elbow the Hair of the Shoulder and the Arm ran contrary to oneanother."

In his work on the descent of man, Mr. Darwin makes the following statement: "It is notorious that man is constructed on the same general type or model with other mammals. All the bones in his skeleton can be compared with corresponding bones in a monkey, bat, or seal. So it is with his muscles, nerves, blood-vessels, and internal viscera. The brain, the most important of all the organs, follows the same law, as shown by Huxley and other anatomists. Bischoff, who is a hostile witness, admits that every chief fissure and fold in the brain of man has its analogy in that of the Orang; but he adds that at no period of development do their brains perfectly agree; nor could this be expected, for otherwise their mental powers would have been the same." And now Dr. Tyson, after comparing all the bones in man's skeleton with the corresponding bones in his monkey, and following the same process with the muscles, nerves, blood-vessels, and internal viscera, comes also to the organ of intelligence, regarding which he observes, "From what is generally received, viz. That the *Brain* is reputed the more immediate Seat of the *Soul* itself; one would be apt to think that since there is so great a disparity between the *Soul* of a *Man* and a *Brute*, the *Organ* likewise in which 'tis placed should be very different, too. Yet by comparing the *Brain* of our *Pygmie* with that of a *Man;* and, with the greatest exactness, observing each Part in both; it was very surprising to me to find so great a resemblance of the one to the other, that nothing could be more. So that when I am describing the *Brain* of our *Pygmie*, you may justly suspect I am describing that of a Man, or may think that I might very well omit it wholly, by referring you to the accounts already given of the *Anatomy* of an *Humane Brain*, for that will indifferently serve for our *Pygmie*, by allowing only for the magnitude of the Parts in *Man*. . . . Since therefore in all respects the *Brain* of our *Pygmie* does so exactly resemble a *Man's*, I might here make the same Reflection the *Parisians* did upon the *Organs* of *Speech*, *That there is no reason to think, that Agents do perform such and such Actions, because they are found with Organs proper thereunto;* for then our *Pygmie* might be really a *Man*. . . . But those *Nobler Faculties* in the *Mind* of *Man* must certainly have a *higher Principle;* and *Matter organized* could never produce them; for why else, where the *Organ* is the same, should not the *Actions* be the same too; and if all depended on the Organ, not only our Pygmie, but other Brutes likewise, would be too near akin to us." CHARLES F. COX.

New York, April 2.

Temperature of the Saco River.

THE monthly mean in the table is based on daily observations of the temperature of the running water at Saco, Me., at the head of the lower falls, about four miles from the mouth of the river. This river is about one hundred miles in length, and has its source in the Notch of the White Mountains of New Hampshire. Flowing nearly in a south-easterly direction, it reaches the sea in latitude 43° 27′, the total fall being about 1,900 feet.

On the 9th of December, 1837, nearly the whole of the water was stopped during the night by anchor-ice, which gradually disappeared, and the full flow of the river was restored at about eleven o'clock A.M.

MEAN MONTHLY TEMPERATURE.

Year.	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1837	32.00°	32.00°	32.00°	36.63°	50.19°	63.77°	71.39°	68.97°	63.53°	49.87°	36.57°	32.39°
1838	32.00	32.00	32.00	43 07	53.26	67.60	73.45	72.71	63.20	49.81	36.87	32.00
1839	32.00	32.00	33.52	46.23	56.78	62.53	71.40	67.42	64.80	54.32		

(No observations were made in November and December, 1839).

Year.	Maximum.		Minimum.		Range.
1837	July 19	73°	Dec. 9	32°	41°
1838	" 31	76	Nov. 25	32	44
1839	" 29	76	Dec. 18	32	44

1837, SOLID LINE; 1838, BROKEN LINE; 1839, DOTTED LINE.

At a recent meeting of the British Association it was decided that observations be made on the temperature of the rivers and lakes of Great Britain. The results thus obtained will be of great value, and will depend on a great variety of causes, among which are the time of exposure to sunlight, the temperature of the earth and the air, the cooling effect of evaporation, the barometric pressure with reference to evaporation, also the effect of the wind in its direction and force, the rapid or gradual melting of snow in the valleys, the turbid or clear condition of the water as to its effect on surface radiation, the exposure of the water to the air at falls and rapids, and the length of time that the surface is covered with ice. JOHN M. BATCHELDER.

Cambridge, Mass., March 9.

Calendar of Societies.

Anthropological Society, Washington.

March 20. — Lester F. Ward, Social and Economic Paradoxes; Edward T. Peters, Observations on the Theory of Rent.

Biological Society, Washington.

March 24. — Cooper Curtice, *Tænia fimbriata*, a New Parasite of Sheep; Charles Hallock, Reversion of Domesticated Animals to a Wild State; J. W. Collins, The Work of the Schooner 'Grampus' in Fish-Culture.

Philosophical Society, Washington.

March 31. — C. V. Riley, Some Recent Entomological Matters of International Concern; H. A. Hazen, Two Balloon Voyages; Thomas Russell, Baudin Vertical Minimum Thermometer à Marteau; C. O. Boutelle, Geodetic Azimuths.

Boston Society of Natural History.

April 4. — Samuel Wells, Life of the late Richard C. Greenleaf; Robert T. Jackson, The Development of the Oyster, with Remarks on Allied Genera.

Purdue Scientific Society, Lafayette, Ind.

March 19. — L. S. Thompson, The Place of Art in Education; W. S. Windle, The Rose-Leaf Spot (*Actinomea Rosæ*); F. W. Brady, The Westinghouse Air-Brake.

Engineers' Club, St. Louis.

March 21. — S. F. Burnet, Cements and Mortar; E. L. Corthell, Inter-oceanic Ship Transfer.

Publications received at Editor's Office, March 12–31.

AMERICAN Legion of Honor Magazine. Vol. I. No. 1. March, 1888 Palmyra, N.Y., F. G. Crandall. 16 p. 8°.

BARROIL, G. Il Tabù. Firenze, Tipografia dell'arte della Stampa. 32 p. 12°.

BONAR, J., *ed.* Letters of David Ricardo to Thomas Robert Malthus, 1810–23. Oxford, Clarendon Pr. 251 p. 8°. $2.75.

CANADA, Annual Report of the Department of the Interior, of the Dominion of, for the year 1887. Ottawa, Government. 8°.

CHAMBERLAIN, M. A Systematic Table of Canadian Birds. St. John, N.B., The Author. 14 p. f°.

HOWELLS, W. D. Indian Summer. Boston, Ticknor. 395 p. 16°. 50 cents.

HUBBELL, W. The Great Amherst Mystery. A True Narrative of the Supernatural. New York, Brentano's. 168 p. 12°. 25 cents.

JAMES, H. E. M. The Long White Mountain; or, a Journey in Manchuria. London and New York, Longmans, Green, & Co. 502 p 8° $6.

KING, T. Haschisch. A Novel. New York, Brentano's. 314 p. 16°. 50 cents.

KLEMM, L. R. Chips from a Teacher's Workshop. Boston, Lee & Shepard. 408 p. 16°.

KNEELAND, S. Volcanoes and Earthquakes. Boston, Lothrop. 220 p. 8°.

PRESTWICH J. Geology, Chemical, Physical, and Stratigraphical. Vol. II Stratigraphical and Physical. Oxford, Clarendon Pr. 606 p. 8°.

RADCLIFFE, C. B. Behind the Tides. London and New York, Macmillan. 65 p. 8°.

REED, H. A. Photography applied to Surveying. New York, Wiley. 68 p. 4°. $2 50.

RICKETTS, P. de P., and RUSSELL, S. H. Skeleton Notes upon Inorganic Chemistry. Part I. Non-metallic Elements. New York, Wiley. 29 p. 12°. $1.50.

SOLDAN, F. L. Grube's Method of teaching Arithmetic explained. Chicago and Boston, Interstate Publ. Co. 66 p. 12°.

THURSTON, R. H. A Manual of Steam-Boilers: their Design, Construction, and Operation. New York, Wiley. 671 p. 8°. $6.

UNIVERSITY of the State of New York, Proceedings of the Twenty-fifth Convocation of the, held July 5, 6, and 7, 1887. Troy, Troy Pr. Co. 232 p. 8°.

UPTON, W., and ROTCH, A. L. Meteorological Observations during the Solar Eclipse, Aug. 19, 1887, made at Chlamostino, Russia. Ann Arbor, Mich., Register Publ. House. 25 p. 8°.

VELSCHOW, F. A. The Natural Law of Relation between Rainfall and Vegetable Life, and its Application to Australia. London, Edward Stanford. 40 p. 12°. 1 shilling.

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SCIENCE

FRIDAY, APRIL 13, 1888.

DESPITE THE SNEERS in some quarters, and vacillation in others, where neither sneers nor vacillation are becoming, the movement in favor of manual training is proceeding with remarkable vigor and rapidity. Ex-Pres. Rutherford B. Hayes recently delivered an excellent address on the subject before the Ohio Legislature, and in the cities of St. Paul and Detroit the school boards are now considering favorable reports presented by special committees on the subject. The Detroit report is so thoroughly representative of the way in which competent school boards are proceeding, that we quote a portion of it. It contains the following passage: "The bulk of our children cannot make a living except through handwork: intellectual training alone is therefore an insufficient preparation for life, so far as they are concerned. Man is by nature a tool-user. As much of his superiority comes from his skilful hands as from his brain. Neglect to educate his hand, and you deprive him of a large portion of his power. The hand is the peer of the intellect: it executes what the mind conceives. The most brilliant ideas are shorn of their splendor if the hand is without the necessary skill to express them. The hand and the mind should receive equal culture. True education looks after the whole man: any education short of this is a failure. To make man a harmonious being, such as he was intended to be by his Creator, all his powers must be equally developed. Such development, according to Everett, was found in Washington, of whom he said that he reminded him of a circle, every point in whose circumference is equally distant from the centre. The present system of education is strongly biassed in favor of professional and literary pursuits, to which there would be no objection were every man's vocation in life, law, medicine, theology, or kindred avocations. But these are not the callings for which the majority are intended. The average man must earn his bread by the sweat of his brow, and must be a producer, in order to obtain support. Manual labor has fallen into disrepute among us, and the result is that the great majority of our young men go into the professions, while we have to go abroad for skilled mechanics. The professions are overstocked, and two-thirds of their members earn precarious livings. Those who do not seek the professions join the huge army of poorly paid clerks and book-keepers, or become Micawbers, dawdling away life 'waiting for something to turn up.' The condition of our girls is still worse. They, too, have been taught to look down upon labor, and their only hope of support is inherited wealth or fortunate marriage. The poor have no fortunes to leave behind them, and the divorce courts tell us that marriage is, alas! too seldom 'love in a cottage.' How shall all this be remedied? By the manual-training school. Educate the hand side by side with the head, and you will dignify labor. The principal reason why the professional man is treated with respect, while the mechanic is regarded as a mere drudge, is because the one is something outside of his pursuit, while the other is practically nothing. There is as much nobility in a piece of fine cabinet work as in a bill in chancery, and yet the world does not think so. Why? Because the lawyer is a man of general intellectual culture, while the mechanic is the contrary. Mix brain with any thing, and you ennoble it. Make a man the victim of mere routine, and you degrade him. No matter how skilful he may be, he will rank no higher than a mere automaton. In fact, the automatic machine which he tends in the shop is considered his superior. All through the centuries, intellectual pursuits have been favored, while manual labor has been treated with disrespect, if not scorn. Plato tells us, in his 'Republic,' that God made men of gold, of silver, and of iron; that those made of the first-named material were intended to be our rulers, those made of the second were to be their assistants, while those made of the third were placed on earth to be hewers of wood and drawers of water. Plato could not see any dignity in mere manhood. Were he alive to-day, however, he would have a higher appreciation of the man of toil. He would learn that this era of the world is termed the reign of the people, and that in the future their pursuits are to be esteemed as highly as the pursuits of those who win bread and fame by the tongue and the pen. This esteem will be accorded to them, not because the achievements of the tongue and the pen are unworthy of the honor which they have heretofore received, but because they will be brought into the service of the workshop. In this glorious future the tools of the artisan, and the books of the scholar, will be regarded as equal members of a happy brotherhood working together in beautiful harmony. As has been said, the son of Vanderbilt's brakeman will then have the same chance for success in life as the son of Vanderbilt. And when that blessed day comes, discontent among the laboring-classes will largely disappear, for no one will then be obliged to run the race of life handicapped with its present inequalities. Give us the manual-training school, and there will be less occasion for strikes, lock-outs, and anti-poverty societies." Whether all the beneficent economic and social effects that the report predicts will follow the introduction of manual training, is at best doubtful; but that the tenor of the report is sound is unquestionable.

CAPT. C. E. DUTTON, of the United States Geological Survey, is now engaged in writing his monograph on the Charleston earthquake. The reports upon which this will be based are complete, and in shape for the public printer. No earthquake of ancient or modern times has ever been observed with so great care and fulness of detail as has that of which the city of Charleston was so near the centre of disturbance. Almost nothing remains to be desired in this report. Besides the observations made by professors in several colleges, by hundreds of railroad officials, and at signal stations, hundreds of intelligent private citizens have reported their own experiences, giving to Captain Dutton a mass of data such as has not before been collected in regard to a dozen earthquakes. This material has, of course, all been carefully digested; and the conclusions which Captain Dutton will present in his monograph will constitute one of the most valuable additions to scientific knowledge yet made through the United States Geological Survey. The same volume will also contain a report on the Sonora earthquake, very abundant material for which has been collected in those portions of the United States to which the *temblor* extended. Mr. Goodfellow's report upon the phenomena of the epicentral region of the disturbance in Sonora was all that was needed to complete the desirable data. Both of these monographs will be ready for the printer by June 1, and an effort will be made to hasten their publication.

AN EXPERIMENT is being tried in Chicago which deserves success. A series of economic conferences between business-men and working-men has been arranged with the purpose of making business-men and working-men acquainted with each other's views. Business-men do not attend working-men's meetings, and only know of their proceedings and debates at second-hand. Similarly working-men have no appreciation of the magnitude and complexity of the problems with which business-men are daily confronted. The

Chicago conferences aim to remove this lack of mutual understanding and appreciation, and to pave the way for a better state of things in that strike-ridden city. The conferences are to take place on successive Sunday evenings, and are seven in number. There are four representatives of the working-men to speak: namely, George A. Schilling, on 'The Aims of the Knights of Labor;' Thomas J. Morgan, on 'The Labor Question from the Standpoint of the Socialist;' Joseph R. Buchanan, on 'A View from the Labor Sanctum;' and A. C. Cameron, on 'An American Trades-Unionist's View of the Social Question.' The business-men are allotted three representatives: Lyman J. Gage speaks on 'Banking and the Social System;' Charles L. Hutchinson, on 'Is the Board of Trade Hostile to the Interests of the Community?' and Franklin MacVeagh, on 'Socialism as a Remedy.' Miscellaneous discussion is not to be allowed at these conferences, because of its obvious dangers; but at the conclusion of each address any one in the audience is to be at liberty to question the speaker on any point, provided the question is stated respectfully. It is hoped that such questions and answers will prove an instructive and profitable feature of each meeting. We shall await with considerable interest some account of these conferences, and their success.

SCHOOL OF MECHANIC ARTS AT THE ALABAMA POLYTECHNIC INSTITUTE.

SINCE manual training as a feature of general education is exciting increased interest, we are gratified to note the advance of this important movement in industrial education in the South, and present as a matter of interest to our readers the plan of the rooms and the scheme of work of the School of Mechanic Arts at the Alabama Polytechnic Institute, Auburn, Ala. This school is under the charge of Mr. George H. Bryant, a graduate of the Massachusetts Institute of Technology.

The department of mechanic arts at the Alabama Polytechnic Institute was organized in 1885, and during the summer of that year the motive plant for the whole department, and the machinery and equipment for the wood-working shop, were purchased and erected. The former consists of a 25-horse power Harris-Corliss engine, steam for which is supplied by a 30-horse power steel, horizontal, tubular boiler, for which a substantial brick boiler-house and chimney were erected.

The wood-shop occupies one half of a room 50×90 feet (the lower story of one of the college-buildings), the other half being taken for the machine-shop. The equipment for this shop comprises the following: 20 double wood-working benches, each with complete set of carpenter's tools; 20 turning-lathes, 10 inches swing, each with set of tools; 1 double circular saw; 1 band saw; 1 surface planer; 1 buzz planer; 2 scroll saws (power); 1 large pattern-maker's lathe; 1 36-inch grindstone. In addition to these, the tool-room is supplied with a variety of extra hand-tools for special work.

During the summer of 1886 a substantial brick building, 32×72 feet, one story high, with monitor roof, was built for the forge and foundery departments. This is divided into two rooms each 35×30 feet, each department occupying one room.

The equipment for the foundery consists of moulding-benches for twelve students, each supplied with a complete set of moulders' tools; a 14-inch cupola with all modern improvements; a brass furnace with a melting capacity of 100 pounds of brass at a heat, with a set of crucibles, tongs, etc.; also a full supply of ladles, large and small moulding-flasks, special tools, etc.

The forge-shop equipment consists of 12 forges of new pattern, each with anvil, set of smith's tools, etc. The blast for all the forges is supplied by a Sturtevant No. 3 steel pressure-blower (which also furnishes blast for the foundery cupola); and a No. 15 Sturtevant exhauster draws the smoke from the fires, and forces it out through the chimney.

In the machine-shop are the following tools: 6 14 inches×6 feet engine-lathes; 2 16 inches×6 feet engine-lathes; 1 22×22 inches×5 feet friction-planer; 1 15-inch shaper; 1 20-inch drill-press; 1 Universal milling-machine; 1 post-drill 15 inches; 1 corundum tool-grinder; 1 bench emery-grinder. Chipping and filing benches for twelve students, each with vise, set of files, chisels, hammers, etc., are provided, one-third of the shop being set apart for this work. In the tool-room are found a good variety of cutting and measuring tools, shop appliances, etc. The full course in mechanic arts runs through three years, as follows:—

First Year.— First term, elementary mechanical drawing (one month), carpentry; second term, carpentry, turning begun; third term, carpentry and turning alternating.

Second Year.— First term, pattern-making (six weeks), foundery-work begun, moulding and casting; second term, foundery-work finished, smithing begun in forge-room; third term, smithing.

Third Year.— First term, chipping and filing; second and third terms, machine-work in metals.

During the second year, lectures are given on moulding and casting, and the metallurgy of iron and steel, and in the third year occasional lectures on mechanical subjects connected with the shop-work.

A special course in steam and mill engineering, with practice with the apparatus, is provided for advanced students who wish to take extra or special work in practical mechanics. The average yearly attendance in this department during the past three years has been about ninety.

SOME SOCIAL AND ECONOMIC PARADOXES.[1]

The Artificial is Superior to the Natural. — Reforms are Chiefly advocated and brought about by Those who have no Personal Interest in Them. — Discontent increases with the Improvement of the Social Condition, etc.

THE progress of science has always been jeopardized by two classes of persons, who, though the exact opposite of each other, are both constantly striving to circulate specious errors under its name. One of these classes of persons seeks to induce belief in improbable things, on the ground that most now accepted truth has once been held to be improbable. The other class seeks to shake confidence in established truths on the ground that they have not yet received mathematical demonstration. On the one hand, theories which are still awaiting proof, or which lie on the extreme confines between the known and the unknown, are taught as established truths; and, on the other hand, great principles whose establishment has cost ages of most laborious research are brushed aside as if they were but visionary hypotheses. The first class judges every thing by analogy; the second confronts every thing with a paradox.

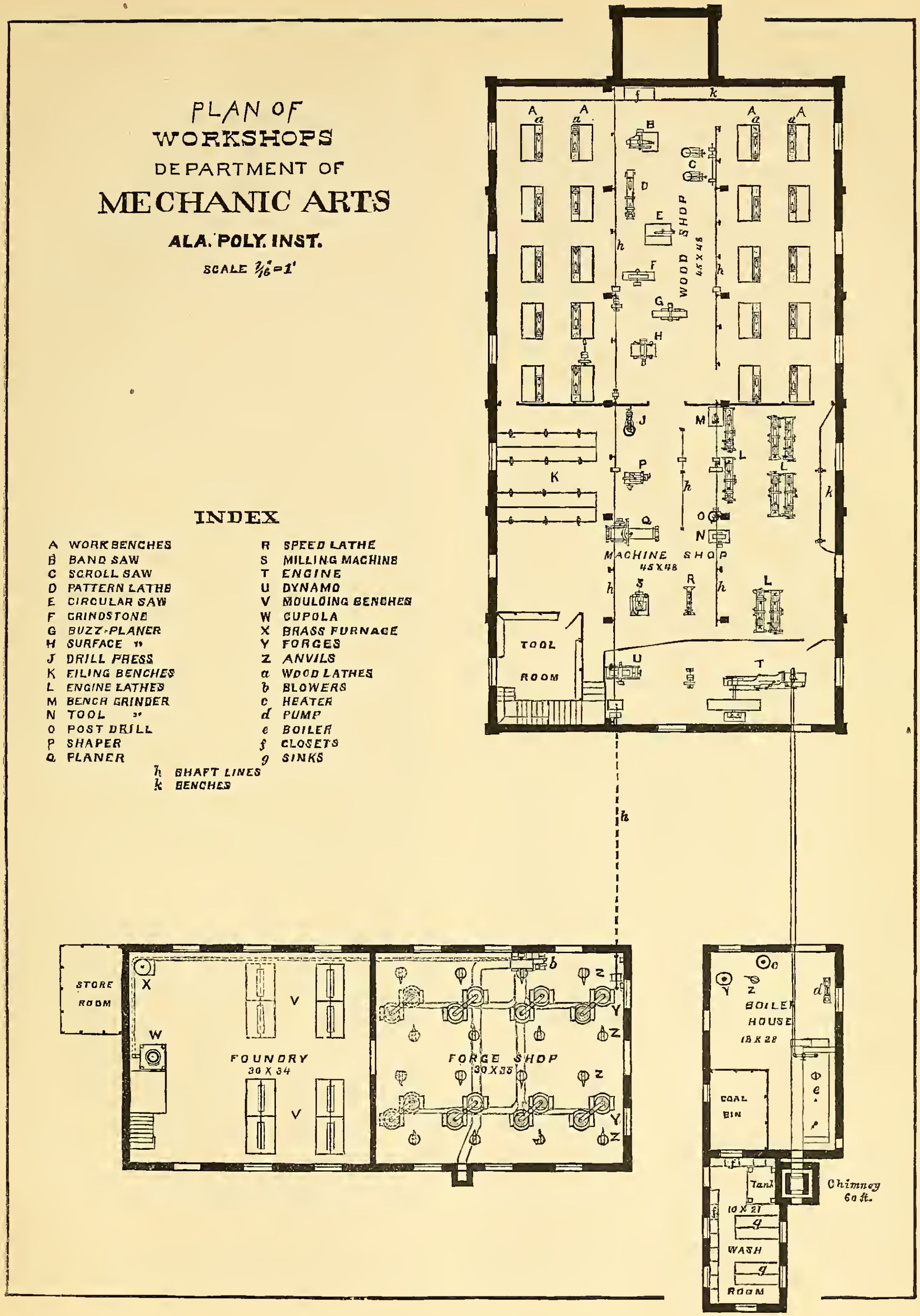
The sincere searcher after truth has much more to do than merely to acquire a knowledge of the truth that has been made known: he has to distinguish between real truth and apparent truth; and this when the apparent truth is presented to him under all the outward guise of real truth, and when the real truth is presented to him in the form of error to be shunned. The two classes may therefore be called respectively 'analoguers' and 'paradoxers,' between whom the honest and uninitiated inquirer must run the gauntlet; and strong indeed must be that judgment that comes through unscathed. There will always be Stokeses and Zöllners to offer specious proofs of what seem impossibilities, as there will always be Lobatschewskys and Dr. Deemses to question geometric opinion, and Dukes of Argyll to undo the work of Darwins.

When, therefore, we approach the subject of the paradoxes of nature, we must do so fully aware that we may be placed in the category of paradoxers in general, and fully prepared to have our paradoxes discounted accordingly. And while the physical paradoxes that the universe presents are most of them too well known in our day to admit of being called in question, as they all were when first announced, I fear that in the case of social and economic paradoxes there will be no body of truth to which appeal can be made.

. . . .

I propose to point out a few of those propositions in sociology, and especially in political economy, which are now on trial, and to indicate what I regard as the probable verdict of history upon their truth or falsity. But in this latter task I do not arrogate to myself

[1] Paper read before the Anthropological Society of Washington, D.C., March 20, 1888, by Prof. L. F. Ward.


PLAN OF
WORKSHOPS
DEPARTMENT OF
MECHANIC ARTS
ALA. POLY. INST.
SCALE 1/16"=1'
INDEX
A WORK BENCHES
B BAND SAW
C SCROLL SAW
D PATTERN LATHE
E CIRCULAR SAW
F GRINDSTONE
G BUZZ-PLANER
H SURFACE "
J DRILL PRESS
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L ENGINE LATHES
M BENCH GRINDER
N TOOL "
O POST DRILL
P SHAPER
Q PLANER
R SPEED LATHE
S MILLING MACHINE
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U DYNAMO
V MOULDING BENCHES
W CUPOLA
X BRASS FURNACE
Y FORGES
Z ANVILS
a WOOD LATHES
b BLOWERS
c HEATER
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WOOD SHOP
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FOUNDRY
30 X 34
FORGE SHOP
30 X 35
BOILER HOUSE
18 X 28
COAL BIN
Tank
10 X 21
WASH ROOM
Chimney
60 ft.

any gift of prophecy, nor pretend that the judgment I shall offer upon any of the cases is to be considered infallible; for so complex or obscure are most of these problems, that it is of the utmost importance to recognize not only that much that seems to be truth is mere analogy, but that a large part of what seems to be false is merely paradoxical.

I shall speak chiefly of certain propositions of modern economic writers which are so much at variance with the current doctrines of political economy, that, if true, they are certainly paradoxic; but before coming to them, and as a sort of preparation for them, I will mention a few others of a much broader character, which, assuming their truth, may properly be called social, or sociologic, paradoxes. I have preferred to treat these propositions as paradoxes in analogy to the paradoxes of physical nature to which I have referred, rather than to treat the better-known and generally accepted dicta which are contradictory to them as popular errors or fallacies, because I deem it less important to lay stress on the error contained in the latter than upon the truth contained in the former, and also because this method of treatment possesses a certain novelty which may lend some interest to a subject which at its best will be regarded as dry, even if it be less 'dismal' than the orthodox political economy has acquired the name of being.

Perhaps the broadest of the paradoxes which can be claimed as sociologic, and which certainly applies to the next lower stage of biologic law, and still more obviously to physical phenomena, is embodied in the theorem that *the artificial is superior to the natural.* Certainly this proposition does not seem true, and, on the contrary, seems to contravene all our common instincts and intuitions; but when subjected to careful study or candid thought, its truth is invincible, at least in those more simple periods of action. For even a well-shaped club is superior to the fists, not to speak of bows and arrows and Springfield rifles. So are houses better than caves; and clothing, however coarse, better than nakedness. The same is true for nearly every material thing to which any value is assigned. And in the organic world the vegetable and animal products which have most value are those which have been perfected by human culture, and are, in so far, artificial.

It is therefore only in the higher stage of sociologic phenomena that this proposition admits of being disputed by the candid student. Here some of the highest authorities stoutly maintain that nature is not to be interfered with, with impunity. But the curious part of their case is, that they base it upon the general negation of our original proposition; viz., upon the ground that the natural is superior to the artificial, — the proposition which in physics and biology is clearly false. It is therefore a *petitio principii.*

The sociologic paradox may, then, be put in this form: *the arbitrary control of the social forces is economical.* Or the converse: *the normal action of the social forces is wasteful.* The orthodox economists maintain that the normal action of laws that govern the social and industrial world are not only economical, but are the very best possible, and cannot be interfered with without injury to the interests of society. And the philosophers of the individualist school take the same view of it. They even deny the expediency of sanitary regulation in cities, and maintain that mortality due to bad drainage is a sufficient inducement to individuals who own the property to combine and perfect the drainage. I cite this merely as an example of the absurd lengths to which this favorite theory leads such writers. In the light of the sanitary progress of the nineteenth century, due entirely to organized social effort, such statements can scarcely be supposed to emanate from the sane mind.

Starting from such extremes, it would not be difficult to show that the general doctrine of *laissez faire* is unsound when contemplated as a universal principle of sociology; and so much has latterly been said upon this point, that all the best writers, even in England, who still desire to hold on to the doctrine, are giving up its universal applicability, and only contending for it on the ground of expediency. Nothing more could be asked, since no fair-minded person will deny that it is often better to allow the most absolute free play to the natural agencies, not merely of society, but of physical nature as well. But that even free trade may sometimes be a very costly policy is as clear as that manufacturers should be authoritatively forbidden to adulterate drugs and articles of food. But not to dwell upon such broad principles and generalizations, and coming nearer to the domain of economics and modern questions of social reform, I will, at the risk of some abruptness, state another paradox in the following words: *reforms are chiefly advocated and brought about by those who have no personal interest in them.*

I do not claim that this is universal, and there usually comes a time in the history of every reform when the victims of the evil to be reformed join in the work, and help to secure its consummation. But in some cases, like the abolition of slavery, even this does not take place. And any one who will take the trouble to inquire into the constitution of those assemblies and associations that meet and organize for various charitable, benevolent, and reformatory objects, will find that they are composed almost exclusively of persons who are actuated by purely altruistic motives, and have nothing to gain beyond the approbation of their fellow-creatures. Even great political reforms are usually instigated and chiefly prosecuted by persons not at all interested in their success, except from some high moral point of view. So much is this the case that working-men's parties are usually officered by lawyers, professors in colleges, clergymen, or writers on social topics. I do not deny that these men may often have selfish designs, but I am not misanthropic enough to doubt that their motives are primarily pure and disinterested. Certainly they are not usually men who would be pecuniarily affected by the success or failure of the reform.

But I have introduced this chiefly in order to lay more special stress upon one of its corollaries; viz., *discontent increases with improvement of the social condition.*

No one will deny to this proposition the character of a true social paradox. Certainly the normal mind would naturally reason, that, as the causes for complaint were removed, the discontent would diminish. But the most careful study of the history of civilization has shown that this is not the case. The reason for this, like the reason for all natural truths which are paradoxes when first stated, is clear when the explanation is given. We saw that in the case of slavery the reform must originate with a different class from the victims of the evil. We even hear of slaves who do not want their freedom. But, however much they may want it, they are in no position to advocate emancipation. And it is largely so with the industrial classes who are not slaves in the literal sense of the term. Virtually they are, up to a certain point, either incapable of realizing the need of reform, or powerless to act in the direction of improving their condition. Discontent is proportional to the degree in which the oppressed class realizes its condition, and increases as the hope grows that an improvement can be brought about by complaint or by concerted action. But this stage is not reached until external influences have already wrought an important change for the better: hence the paradox that discontent increases with improvement. It presupposes, however, that real hardship exists, and would not be true where entire justice was done.

The special importance of this law arises from the fact that one of the leading arguments against all attempts at industrial reforms has been that the condition of the laboring-classes is really improving. Mr. Henry George has greatly injured his case in denying this, such denial being implied in the title of his book, 'Progress and Poverty,' and repeatedly enforced throughout the work. Though bad for Mr. George, this course has proved useful in startling both classes, and spurring them on to investigate the facts. Both have now learned the truth, that the condition of the working-classes has improved, and greatly improved, in nearly all civilized countries. The opponents of further labor-reform point to these facts, and declare that there is no ground for complaint, and imagine they have closed the argument. But the wiser among the reformers perceive that it is just this improvement which has rendered discontent possible, and they rightly regard this as demonstrating that the reform is not yet complete, and propose to continue to agitate until the triumph of justice shall in a natural way put an end to all discussion.

I shall consider only one more of these broader sociologic paradoxes. This is embodied in the proposition that *the means of subsistence increases more rapidly than population.*

This, as you all observe, is the exact opposite of the Malthusian law. The almost universal acceptation of that law is sufficient to stamp this as a paradox, provided it be true. Mr. Henry George was, I believe, the first writer who had the courage to formulate it and attempt its substantiation. In this, I must admit, he has been successful. After reading his argument, one is inclined to wonder how any other view could ever have been taken. Society is really a great co-operative institution, and as such it has succeeded in economizing the forces of production. All who understand what the value of co-operation consists in, know that the more general it is, the more effective. Society, though a very imperfect form of co-operation, is a very general one, and it results, defective as it is, in a greater production *per capita* than could be secured by individuals each working for himself; that is to say, the larger the population of any given community, the greater the amount of subsistence that each can and does produce.

There are two curious facts that result from this, both of which are decidedly paradoxical in their character. One is, that this is the very truth which has been so exultantly brought out by the chief defenders of Malthusianism when they showed that the condition of the disaffected classes is improving. It is improving, and has been improving, with a few interruptions, ever since the beginning of the industrial epoch; but this improvement has been the result of social co-operation, division of labor, employment of machinery and all the other agencies that result from social integration and the increase and massing of population. The more dense the population, the greater the friction of mind upon mind, the more rapid the development of intelligence, the quicker the action of the inventive faculty, and the more exact, methodical, and economical the outlay of energy in the production of wealth. Everybody is familiar with this law in the obvious contrast between intelligence and thrift of city and country population. As Mr. George has well said, the world has never yet reached a point at which the population was too dense to create wealth, not merely in proportion to the subsistence required, but in excess of it. Thus far all experiments which history affords have proved the law above formulated in diametrical antithesis to the so-called 'law of Malthus,' and shown that production increases with population in some ratio greater than unity. The second curious result of this truth so successfully established by Mr. George, is that it serves as a flat contradiction of the fundamental theorem of his book; viz., that poverty increases with wealth. It would, of course, be easy to find isolated cases, perhaps important departments of industry, in which the haphazard development of modern wealth-producing agencies has worked severe temporary hardship; but that they tend, using the old phrase, "to make the rich richer, and the poor poorer," in any permanent or systematic way, may be regarded as apodictically disproved. Coming next more nearly within the field of political economy as that science is usually defined, let us note a paradox which may be regarded as a corollary of the one last considered. It may be stated in this form: *capital is more effective than labor in the production of wealth.*

In the view of the popular belief that labor creates all wealth, this, if true, must certainly rank as a paradox. To understand its truth we must consider what constitutes capital. To do this we must loose entirely from all the current definitions which may, however, also be true, and look at it from one special point of view. It is a common thing to hear it said that in the modern industrial world it is not human power that produces most of the wealth, but natural forces. This is true, and is one way of looking at it. It is equally common to hear it said that it is not muscle, but brain, that accomplishes the principal results. This is also true, and another way of looking at it. Brain, i.e., intelligence, organizes and directs natural forces, and the latter do the work. Still a third point of view is expressed when it is said that it is machinery which does it. Machinery is the material embodiment of intelligent direction of natural forces. But very few, I imagine, have taken the fourth step in this train of reasoning, and attributed the result to capital. Yet this view is perfectly legitimate, and a necessary sequence of logic. The term 'machinery' is too narrow. Much of the force will not admit of being referred to it. The expression 'natural forces' is often not strictly applicable. Animals often supply the motive power. 'Intelligence' is too vague a term to reduce to economic language. But 'capital' includes every possible agency, and it is really to this that all production beyond what could have resulted from naked human muscle is due. This, I need not tell this society, is the greatest bulk of all that makes up civilization. We thus come back to the paradox with which we started out, of the artificial over the natural.

We will next consider the proposition that *wages are drawn from products, not from capital.*

The old economists all maintain that there was a particular part of capital, called the 'wages fund,' from which all wages were paid, and without which, or beyond which, no wages could, under any circumstances, be paid. Mr. Henry George has shown that there is nothing of the kind; and so clear is his demonstration upon this point, that Professor Clark, in his admirable little work on the philosophy of wealth, pronounces his reasoning as clear as any thing in mathematics. Capital, as we have seen, consists in the machinery, tools, appliances, and other labor-saving agencies, employed to increase production. Money, except when used for these purposes, is not capital. The idea that the manufacturer lays aside a certain sum of money to pay for his labor, which he keeps distinct from his profits, as a wages fund, is sufficiently absurd to need no disproof. What he really does is to count the sum needed to pay his laborers out of his profits as current earnings devoted to production, and it is out of production that this sum must come from week to week or from day to day. For myself, however, I can see no distinction between this and the money devoted to the purchase of tools or machinery. It is capital in the true sense of the term as wealth applied to production.

We are now prepared to consider what I regard as the most important, as it is the least unequivocal, of all economic paradoxes. It may be expressed in the following form: *profits rise with wages*, or in the stronger form; *increase of wages results in increased profits.*

Surely this proposition would stagger an old-time political-economist; and very few employers, with all their mercantile sagacity reputed to be so unerring, could be brought to accept it. In fact, not only is the exact opposite theory the only one taught in the books, but the business of the whole world has always been conducted upon it, and to the normal mind the statement that profits will diminish as wages increase seems to be self-evident. How, then, can the opposite be maintained? We owe to Mr. George Gunton, the author of a recent work entitled 'Wealth and Progress,' the full elaboration of this new theorem; and any believer in the old one who will carefully read this book, provided he be really seeking the truth, can scarcely fail to admit that there are two sides to the question. For myself, I can scarcely resist the acceptance of the new doctrine, though, of course, with certain qualifications and reservations. It is something like the argument for non-resistance. Any one who understands it must admit its truth; and yet for those who believe it, so long as their number is small, to undertake to apply it, would be ruinous to themselves, and would seem to disprove the doctrine itself.

Mr. Gunton's method of exposition is something like the following: political economy, as expounded in all the books, teaches that industrial society is divided into two great classes, — producers and consumers. In this classification the wage-receivers are uniformly classed as producers. The consumers are a class who go into the market, and purchase the products wrought by the wage-receivers. They are vaguely conceived, illy defined, never distinctly located, and, except that they actually buy the goods and consume them, they are a sort of economic myth. But Mr. Gunton asks, "Who are these consumers? Where are they? What are they?" A consumer is a human being. He is part of the population. Somewhere in the population he is to be found. In fact, the consumers are the whole population. The wage-receivers must therefore also be consumers; and when we take the census of population, we find that they, with their families, constitute the greatest majority. Therefore, in all calculations based upon the nature of the market, not only must they not be ignored, but they must be regarded as the prime factor. But it may be said that they consume much less than the other classes of people. Their humble rank and simple wants make them scanty consumers, and therefore it is necessary to bid for the wealthy classes, and neglect the laboring-classes. No one will claim that they consume as much *per capita* as the rich, certainly not of certain products. But here, again, Mr. Gunton asks, "Why?" The obvious answer is, "Because they have not the means." But will any one claim that the working-classes consume all they would if they had the means? Surely not. There may be some so low that they could make no use of any thing more than they have, but this is hardly conceivable. With scarcely an exception, they want much which they cannot have because they have not the means to purchase it. But their means consist wholly in their wages. To increase their wages is to supply their wants. This is all they think of. But the employer is apt to look at the question as though all money paid for labor beyond the minimum possible would be hoarded in the cellar and lost to industry. This view, tacitly shared by the economists, is obviously false. What is supplying wants to the laborer is furnishing a market to the manufacturer or the farmer. The vast number of laborers, and the certainty that all increase of wages will be expended and not hoarded, make even the smallest general rise in wages an important stimulus to production. It expands the market for all classes of products. Statistics show that periods of high wages have uniformly been periods of increased production, and increased production means prosperity to the manufacturer; i.e., profits rise as wages rise.

Time fails me to elaborate this important principle as it has been done in Mr. Gunton's book, and I can only recommend those interested to read his argument for themselves. From this, however, as the fundamental theorem, a large number of new and striking truths, most of them in the nature of paradoxes, arise. Only a few of them can be considered here. One of them is that *prices fall as wages rise*. This is maintained by Mr. Gunton, in face of his general law that the price is determined by the cost of production. Surely one would suppose that the cost of production would be greater if the cost of labor were increased. Just here lies the paradox. Doubtless this would be true for an isolated case, but it would not where the rise of wages was on a large scale. The reason is, that, with the increase of wages, the market is increased and production is increased. As the production was at the minimum for existing methods before, the increased production must now be brought about by an improvement in the methods; i.e., by introduction of improved machinery. This always lessens the cost of production; and this, according to the law above stated, will sooner or later compel a reduction in the prices of commodities thus more cheaply produced.

Another of these statements which Mr. Gunton claims to establish by statistics is, that *rents rise with wages*.

One would naturally suppose that rent, as the price paid for lodgings or business-offices, or space to build or work upon, or for agricultural purposes, would follow the law of prices, and fall as wages rose. Mr. George virtually asserted this in maintaining that the rent was taken out of wages, so that the higher the rent the lower the wages. But Mr. Gunton shows, that, as rents have risen, wages have risen; that the highest wages are paid where the highest rents are charged, i.e., in cities; and that the lowest of all wages are received by those who pay no rent, but occupy the soil without let or hindrance. The argument is scarcely fair, and the truth seems to be, that, as wages rise higher, rents will be paid, but better tenements will be occupied; so that the case is on a par with the last, that increase of wages increases consumption, which is seen in better habitations, the same as in better clothes and furniture.

But perhaps the most important of Mr. Gunton's conclusions are those relating to the hours of labor. Two of these may be briefly considered. One of these is that *a reduction of hours tends to increase production*.

This, perhaps, sounds more paradoxical than any of the preceding propositions. Surely one would naturally suppose that there would be more produced in ten hours than in eight. Not so. The laborer remains a consumer the same after as before the reduction. Unless new machinery is introduced, the same amount of labor will be required after the reduction as before: hence a larger number of laborers must be employed. These, in the present condition of society, are always to be had. The number of able-bodied persons constantly seeking or out of employment is equal to one-fifth of the whole. These unemployed persons would at once find employment. While unemployed, the amount consumed by them is at an absolute minimum. As soon as they begin to receive wages, they begin to consume more, and thus the demand for various kinds of commodities is increased. This demand is sure to be supplied by increased production, which will be secured by the introduction of improved machinery if it cannot be done otherwise.

But this is not the only way in which a reduction of the hours of labor works the increase of production. By affording a little leisure to the workingman, it gives him a taste, or rather an opportunity to indulge taste already possessed, for certain elements of culture and social refinements, which he will then begin to demand, and which will be accordingly supplied by the general law of demand and supply, which supply consists in increased production. But, assuming that all his earnings were previously expended on necessities, this would be impossible, and hence arises a final paradox that *the reduction of hours tends to increase wages*.

But for the foregoing explanations this would be strange enough. Whenever there is a demand for a reduction of hours, it is always met by the reply, that, in the state of business, it can only be granted on condition that wages be correspondingly reduced. And this would doubtless be necessary with many isolated industries, at least at the outset. A reduction of hours is considered equivalent to an increase of wages. But a general reduction of hours, continued long enough to have its natural and final effect upon society and upon industry, will create an increased demand for all classes of commodities requiring the introduction of improved machinery for their production, thus cheapening the cost of production, increasing the profits of the manufacturer, and enabling him to pay higher wages and still enjoy greater profits. This, under free competition, he will be compelled to do, and will do in harmony with the economic laws of society.

Without further argument of these several propositions, I will close this paper with a single comment. If any considerable part of what is claimed is true, it proves in a most conclusive manner what I have so often insisted upon, — that to the power of production there is practically no limit, and that all that is needed to place in the possession of every member of society every object of his most cherished desire is the power to purchase it. Very few indeed are there who possess, or can possess, every purchasable object of desire. The present production of industrial society would not be equal to a tenth, probably not a hundredth, of what would be consumed if every one could supply at will every proper and legitimate want of his nature. It is therefore useless to talk of increasing production except by the increase of the power to consume. This is demand in its true economic sense, — the demand which will be supplied by the natural operation of industrial laws. We have therefore narrowed down the great economic problem to the one single point of how to enable the members of society to secure for an equivalent the objects which they desire to consume. Mr. Gunton has sounded the keynote of the solution of this problem in demanding increased wages and reduced hours of labor for the great consuming class of workingmen, — in popular phrase, the 'toiling millions.' It remains for other economic philosophers to show how this principle can be extended to include all mankind.

ELECTRICAL SCIENCE.

Electric Tramways in Great Britain.

The paper on the Bessbrook and Newry tramway, read by Dr. Hopkinson before the Institute of Civil Engineers, has brought forward some valuable information as to the status of electric tramways in Great Britain. Last year there were eight tramways operated by electricity in Great Britain. The longest is 6 miles; the shortest, $\frac{3}{4}$ of a mile; the average being $2\frac{3}{4}$ miles. The power for the two shortest of these is from gas; for two of the longest, from water; for the rest, from steam. The electricity is transmitted by rails, — in some cases specially insulated central or side rails, — or accumulators are carried on the cars; the overhead system so generally adopted in this country and in Germany being in no case used.

The Bessbrook and Newry line is $3\frac{1}{4}$ miles long, with an average gradient of 1 in 86, a maximum gradient of 1 in 50. The conditions are, that ten trains run in each direction per day for a daily traffic of 100 tons each way, and a maximum capacity of 200 tons per day, in addition to the passenger traffic. The electrical locomotive draws a gross load of 18 tons, in addition to passengers and its own weight, at an average speed of 6 miles per hour: with 12 tons load, its speed is 9 miles per hour.

The generating dynamos are driven from a turbine at about one-third the distance from the Bessbrook end of the line. The weight of the motor-cars is distributed as follows: —

	Tons.	Cwt.	Qrs.
Car body	3	6	1
Leading truck	1	17	2
Rear "	1	0	0
Motor and accessories	2	1	1
	8	5	0

The current is conveyed to the car through a central rail insulated on blocks of paraffined wood, returning through the earth and track. The gearing is first from the motor-axle through a spur-gear to a countershaft, then from the countershaft to the car-axle by a chain gearing. The total cost of the line and equipment, including two locomotive cars, was £2,500. The cost of running per train mile has been 4.2 d.

During the discussion, Mr. Lineff brought forward a comparison between the cost of conductors and accumulators for electric traction. He assumes the interest and depreciation of conductors at ten per cent; of accumulators, at thirty per cent; representing overhead conductors by A; underground by B, and batteries by C.

Length of Line.	Two Cars.			Four Cars.			Six Cars.			Eight Cars.			Ten Cars.		
	A.	B.	C.	A.	B	C.	A.	B.	C.	A.	B.	C.	A.	B.	C.
1 mile	200	1,500	2,400	225	1,525	4,800	250	1,550	7,200	275	1,575	9,600	300	1,600	12,000
2 miles	400	3,000	2,400	450	3,050	4,800	500	3,100	7,200	550	3,150	9,600	600	3,200	12,000
3 "	600	4,500	2,400	675	4,575	4,800	750	4,650	7,200	825	4,725	9,600	900	4,800	12,000
4 "	800	6,000	2,400	900	6,100	4,800	1,000	6,200	7,200	1,100	6,300	9,600	1,200	6,400	12,000

Mr. Lineff assumes that each car needs three sets of storage-cells, $1\frac{1}{2}$ tons in each set, at £60 per ton; and the cost is increased three times in the table to allow for three times the depreciation as compared with conductors. The increased cost of cars and motors for the accumulators is taken at fifty per cent of their value. In reality there would be required but two sets of cells per car, while the increased cost of each car could hardly be the £135 assumed. The comparison, then, is hardly fair to the accumulators. Instead of the £400 per car assumed, £250 would be a fairer price, the cost of the cells being taken at £60 per ton. As it stands, in a line four miles long the accumulators would be cheaper for five cars or less, as compared with underground conductors, while the overhead wire would cost less than either for any number of cars. If the lower estimate given be assumed, then the cost of underground conductors and accumulators will be the same on a four-mile line when about nine cars are run. Any increase in the length of the line favors the storage-battery: an increase in the number of cars favors the underground conductor. Still in this estimate there is not included any consideration of reliability and flexibility, and in these the storage has many advantages over any other system. It will be seen, however, that the overhead conductor is cheaper than either of the other plans, and in the smaller towns and the suburbs of cities it will probably be generally adopted.

HIGH CANDLE-POWER INCANDESCENT LAMPS. — An English firm, Clark, Chapman, Parsons, & Co., are manufacturing incandescent lamps of candle-powers up to 1,000 candles. They consume about 2 watts per candle, and have a life of 800 hours. It is very possible that the life and efficiency of these lamps will be improved, in which case they will be active competitors with arc-lamps for street-lighting. If the intensity of 1,000 candles is honestly measured, and gives the average of the light in all directions, then the efficiency is about half that of the ordinary arc-lamp. The price of the incandescent lamps is not given; but we may suppose that the cost of renewal will not be much in excess of that of the carbons used in the arc-lamps, while the attendance will cost little or nothing. The lamps would seem to have a wide field for application in buildings where a high candle-power is desired, and where the irregularities of arc-lamps are objectionable. The voltage used is 100; the ampères, 20.

THE GIBSON STORAGE-BATTERY. — In this cell the plates are made by fixing peroxide of lead in perforations in a lead plate. In the ordinary 'grid' form of storage-battery plate the holes are of an hour-glass form, — smallest in the middle, — the contraction preventing the plug of active material from falling out. This has the disadvantage that the pressure caused by the gradual corrosion of the grid has a tendency to break the plug in the middle and force it out. To remedy this, M. Godot invented a plate in which the hole was largest in the middle, and smallest at the surface. The objection to M. Godot's plate is in difficulty and cost of manufacture. In the Gibson form the holes go square through the plate: in them are put capsules of peroxide of lead in the form of a paste. The capsules only fit loosely in the holes, and extend beyond the surface. Plates thus prepared are passed between rollers set at such a distance apart that they press the capsules to the level of the surface of the plate, at the same time flattening the lead slightly, and causing the edges to overlap the holes, thus keeping the active material in. The method seems a decided improvement over that of M. Godot to accomplish the same purpose: very possibly, if tried with the best possible form of plate, it will be an improvement on the ordinary 'grid' type. It hardly seems probable, however, that it will improve either the efficiency of the battery or storage capacity, although it might increase the rate of discharge and the life of the plate.

MAGNESIUM IN PRIMARY BATTERIES. — M. Hein has been investigating the value of magnesium as a positive element in primary batteries. The electro-motive forces are high as compared with results ordinarily obtained; but there are the objections that magnesium is expensive (it is worth from a dollar and a half to two dollars a pound), and the resistance of the solutions of magnesium salts is greater than that of the ordinary solutions used.

Positive Element.	*Solution.*	*Negative Element.*	*Solution.*	*Electro-motive Force.*
Magnesium	Dilute sulphuric acid	Zinc	Dilute sulphuric acid	.876
"	" " "	Copper	Sulphate of copper	2.03
"	Sulphate of magnesium	"	" " "	1.93
Magnesium	Dilute sulphuric acid	Carbon	Dilute nitric acid	2.888
"	Sulphate of magnesium	"	" " "	2.863
"	Chloride of magnesium	"	" " "	2.910
Magnesium	Bichromate solution	Carbon	Bichromate solution.	2.952
"	Dilute sulphuric acid	"	" "	2.980
"	Sulphate of magnesium	"	" "	2.901
"	Chloride of magnesium	"	" "	2.970
Magnesium	Chloride of ammonia	Carbon and manganese dioxide.		2.219
"	Chloride of magnesium	"		2.334

MENTAL SCIENCE.

Psychic Disturbances in Russia.

THE subjection to law, of phenomena apparently the result of free individual choice, forms one of the most interesting results of the application of scientific methods to the observation of mental facts. Statistics have made us so familiar with this type of facts, that we are apt to overlook their real significance. The number of suicides, to take one instance of many, we know to be quite constant (in the absence of unusual causes) from one year to another, and yet we usually regard this act as the result of a voluntary deliberation. The various classes of crimes are subject to a similar regularity; and one writer has gone so far as to say that a criminal is as much a manufactured product as is calico, only the methods of production are not so well understood in the former as in the latter case. When any marked deviation in the regularity of such phenomena presents itself, we at once look about for some definite cause, and from a consideration of such causes we are enabled to predict, or at least to confidently expect, that with the presence of such unusual causes there will be found unusual deviations in the prevalence of the phenomena that depend upon it. Thus M. De Candolle, from a study of the frequency of eminent *savants* in various countries, tabulates a series of influences that foster the development of science as well as of those that hinder its growth, and is even able to ascribe a relative importance to these influences. A very striking illustration of the intimate relation between two such series of facts is to be found in an article by N. Tsakni (*Contemporary Review*, March, 1888), upon 'Mystical Pessimism in Russia.' The debasing social, political, and educational conditions that exist in that country have been compared to those of the middle ages, as well as to the times preceding the French revolution. The psychic pestilences that devastated mediæval Europe, the host of absurd and fanatic extravagances that took possession of France in the last century, seem to the psychologist to follow as necessarily from the low mentality and unnatural mode of living of the people as does insanity from a disordered brain. It is not surprising, then, to find in Russia a fertile soil for all kinds of superstitious and abnormal growths.

"Pessimism," in the words of the writer whose article we are to follow, "is a characteristic feature of all those epochs of history in which the mass of human suffering is at a maximum, and moral aspirations are entirely out of harmony with social conditions. Involved in an unequal conflict with their surroundings, men come to regard life as a terrible burden, and seek refuge in suicide, or in strange, mystical, and extravagant theories of society." This is the condition of Russia to-day, and as a consequence it is overrun by a series of barbaric occurrences which it is hard to believe are going on in our day. Spiritualism flourishes, and is constantly on the increase: all sorts of religious sects flourish among the well-to-do as well as among the peasantry. Faith in sorcery and the supernatural is everywhere current: a large number of persons earn a living by predicting fortunes and reading the future from the palm of the hand. A simple peasant woman had such a reputation in this regard, that not only the peasants, but even the officials, always consulted her before any serious undertaking. A belief in the evil eye and a host of superstitious cures is wide-spread. Recently a retired officer acquired a reputation for removing hysteria by exorcism; and the leisure classes flocked to this pretender, who repeated cabalistic formulæ as a cure for insanity, paralysis, and inebriety. The small intelligent population is merely an oasis in the vast desert of the population, ignorant, superstitious, and unhappy. Hysterical outbreaks are frequent, and men and women scream like madmen, fall into convulsions, and announce the end of the world. Sects are formed to preach the misery of life, and death as the sole road to salvation.

About twenty years ago a peasant in the province of Perm, after spending much time in the reading of religious books, concluded that the end of the world was at hand, and converted his neighbors to his belief. Voluntary suicide was the only release from the misery that surrounded them. A number of men, women, and children, including the members of his own family, retired to a forest, where the men dug catacombs, while the women made shrouds. This lasted three days. Then all the disciples, dressed in the garments of death, three times renounced Satan. The leader gave the command, "Take no food and no drink for twelve days, and you shall enter the kingdom of heaven." Then the days of suffering began. A few, more human than the rest, appealed in behalf of the children, whom they saw writhing in agony, and sucking blades of grass or eating sand; but the leader was immovable. At length two of the fanatics could endure it no longer, and fled. This frightened the band, and the leader announced that the hour of death had come. They massacred the children, and decided to continue the fast. At this stage the police had sought them out, but their frenzy was kindled to the highest pitch. With the prospect of capture before them, a horrible carnage ensued. They killed the women with hatchets, and the efforts of the police only succeeded in saving the leader and three of his associates.

Another instance is that of the monk Falaré, who, not many years ago, went along the banks of the Volga, preaching suicide with great success. One night eighty-four persons met in a cavern that had been filled with straw. They began to fast and pray; but one woman fled, and informed the police. As their pursuers appeared, they set fire to the straw, and threw themselves upon it, killing themselves with hatchets. Many were saved, however, and one of the condemned escaped from prison, and continued to propagate the doctrine. More than sixty persons, including whole families, became his disciples. A day was fixed upon which one peasant went to the houses of the others, killing men, women, and children, all calmly submitting to their fate. The leader then had himself killed. Thirty-five persons, in all, thus perished. These *en masse* massacres are becoming more rare, but all kinds of crimes are still perpetrated as the result of a religious fanaticism. In 1870 a woman threw her child into the fire in obedience to a divine command, and showed no signs of remorse when called to trial. A dozen years ago a man crucified himself, actually nailing his feet and one hand to a cross, and then impaling the other on a nail.

Sects with less horrible practices are numerous. One such calls itself the 'Negators,' and its members keep themselves aloof from all men. They recognize no government, no right, no duty, no property, no marriage, no rites of any kind. Each stands for himself, and life is of no value. They oppose compulsory labor, and neither hire themselves as nor keep servants. They lead lawless lives, and spend much of their time in prison. About twenty-five years ago the 'Jumper' (Prigoony) appeared. They found many followers in the Caucasus and the neighboring mountains, where prisoners had been exiled. The chief apostle of the sect called himself God, and among their doctrines was the gaining of insight by prayer and ecstasy. The face would grow pale, the breath be quickened; then the body would sway, the feet begin to beat, followed by jumping and violent contortions, until exhaustion ensued. Some cry and declare the Spirit is upon them. The meeting ends by a fraternal kiss among all the members, men and women. They abstain from many kinds of food, allow no stimulants, and forbid all even the most innocent pleasure. Their time is spent in praying and fasting, but they have no ceremonials of any kind. A group of these calls itself the 'Children of Zion.' They live in solitary houses, and scourge themselves, jumping and shrieking until they are possessed. They fast, often letting their women and children die of hunger. They believe the end of the world to be near, and regard themselves, as do other sects, as the only true Christians. They predict a kingdom of Zion that shall last for a thousand years. Their leader has twelve apostles and a number of queens. When once displeased, he threatened to fly to heaven. Another sect are the 'Communists,' who regard themselves as the elect people of God. They, too, have ecstasies, and predict the end of the world. A man of twenty-five and a girl of eighteen represent Christ and the Virgin among them, and receive homage. They preach an equal ownership in property, and a rich citizen gave up his property to be divided among them. The police has interfered with the organization, but it is still secretly propagated. These are only samples of the many social and religious disturbances that give evidence of the abnormal state of mind under which these unfortunate people live.

ILLUSIONS OF SIGHT AND MOTION. — The senses are subject to illusions in proportion to the remoteness of the information that they give from the immediate necessities of the organism. Touch, the most immediate and least inferential of the senses, is least subject to illusions; while sight is so very much so, that the blind often say they have an advantage over the seeing in being free from visual illusions. The illusions of bodily motion are much nearer to those of touch than to those of sight, and yet they can under certain conditions be induced through visual impressions. Of this the writer has recently had two interesting examples. He was standing upon the floor of a railroad-depot, the boards of which were laid with a considerable open space between them; and the shadow of an electric light was moving up and down by the swinging of the light in the wind. Looking at the floor, it seemed as though the shadow were stationary, and the floor-boards moving. From this it followed that the person on it was moving too, and the writer distinctly felt the swinging sensation: in fact, his attention was called to the phenomena by this feeling of motion. The other observation was as follows: while riding in the cars and looking out of the window, the trees and all are seen to move in the opposite direction. If, now, one looks in a mirror so situated that it reflects the passing landscape, which, however, must not be visible except in the mirror, one has the illusion of moving in the opposite to the real direction of motion, owing to the reversal of the image in the glass. In both these cases an immediate bodily sensation is induced by a more or less unconscious inference through visual sensations.

HEALTH MATTERS.

Scarlet-Fever.

ONE of the most valuable communications which we have received in answer to the series of questions which were propounded relative to scarlet-fever in *Science* of Dec. 16, 1887, is that from the pen of Dr. Henry B. Baker, secretary of the State Board of Health of Michigan. The arrangements which Dr. Baker has instituted for obtaining information from every town and village of the State are so thorough and complete, that the deductions made from the statistics thus obtained are especially valuable and trustworthy.

Dr. Baker does not believe that scarlet-fever ever arises *de novo*, but, judging from researches by Dr. Klein and others, thinks it is possible that the pre-existing case may have been a cow or some other animal, and not a human being. There is no doubt in his mind that scarlet-fever is a communicable disease; and he gives the following instances which have come under his own personal observation, tending to prove this communicability: —

(*a*) A child about four years old was taken sick with scarlet-fever a few days after putting on a cloak made in a room in which was a little girl convalescent from scarlet-fever.

(*b*) A young woman came into the (small) residence in which a child was sick with scarlet-fever, remained less than an hour, rode several miles into the country, where in a few days she was taken sick with scarlet-fever.

(*c*) Members of the family into which was introduced the young woman mentioned above, in a few days were taken sick with scarlet-fever, and one of them died.

In reference to the communication of bovine scarlet-fever to man, either by contagion or the milk of affected animals, he has no information except that which has already been given relating to the Hendon dairy, of which he says that the evidence of scarlet-fever being communicated from diseased milch-cows is given by Mr. Power and Dr. Klein, who traced outbreaks of scarlet-fever to milk received from diseased cows on the Hendon farm in England. Milk from these cows was distributed by all the distributers of milk from the Hendon farm except one, and this was the only district supplied by milk from this farm which was not affected with scarlet-fever. Dr. Klein obtained from these cows a particular microbe identical with the micrococcus found in persons affected with scarlet-fever. Other cows inoculated with the micrococcus from scarlet-fever patients became affected with a cutaneous and visceral disease similar to that which affected the Hendon cows. We have already (*Science*, Feb. 10, 1888) referred to the fact that these observations of Power and Klein are disputed by Professor Crookshank, who investigated the matter for the English privy council. Crookshank believes that the disease was cow-pox, and not scarlet-fever, and that, as a natural sequence, the outbreak of scarlet-fever attributed by Klein to the Hendon cows had no connection with them whatever. In Dr. Baker's opinion, a person who has had scarlet-fever is probably liable to communicate the disease to others until after the completion of the process of desquamation (peeling or scaling of the outer skin), which process also occurs to surfaces in the interior of the body, and which, on some external parts, *may* not be completed for two or three months. But without bathing, and change of clothing or its thorough disinfection, a person may communicate scarlet-fever many months after desquamation has ceased. Cases illustrative of this are recorded on p. 257 of the 'Report of the Michigan State Board of Health for 1885,' p. 275 of the report for 1884, and p. 219 of the report for 1886.

Dr. Baker has personally known of instances where articles of clothing, books, etc., have retained infection for a few weeks; but he has known, by means of reliable information, of the infection having been retained for much longer times. For instance, a trustworthy physician informed him that a patient of his, being cold, went to a closet and procured a cape worn by his brother one year before, during convalescence from scarlet-fever. In a few days he was himself taken sick with scarlet-fever. Dr. Baker thinks that boards of health should not require reports of cases of scarlet-fever to be made to them unless the people themselves have by law made provision therefor. Nothing is gained by boards of health, or other servants of the people, attempting to dogmatically force people to do what their intelligence, or lack of it, does not lead them to see is right and just. Boards of health should strive to put the facts before the people, and to execute existing laws.

The *people* should by law require that prompt report be given to the local health-officer, on the occurrence of a case of scarlet-fever. Proper penalty should be affixed to the violation of this law, and the law should be enforced by the prosecuting attorney. The report should be required to be made by every householder, hotel-keeper, keeper of a boarding house, or tenant, who shall know, or shall be informed by a physician, or shall have reason to believe, that any person in his family, hotel, boarding-house, or premises is taken sick with scarlet-fever. The notice should state the name of the person sick, and so designate the house or room in which the person is as to enable the health-officer to enter at once upon his duties of restricting the disease as promptly as the fire department enters upon the restriction of a fire. The penalty should not be enforced against a householder, etc., if the case is at once properly reported by the physician. Every physician should be required to report to the local health-officer every case of scarlet-fever which comes under his observation. A fee should be paid by the people to the physician who makes such a report for the public good.

The reasons why notice of scarlet-fever should be given are similar to those why public notice of a fire should be promptly given by whoever gains the knowledge first. The common safety of life is endangered by keeping such knowledge secret. No one person's or few persons' interests should be permitted to weigh against the interest of humanity at large.

If the law permits, it is the duty of the board of health to act as promptly for the restriction of the disease as the fire department acts for the restriction of a fire, and for similar reasons: life and property are in jeopardy so long as the case is not isolated.

The law should require the health officer[1] (*a*) immediately to investigate the subject, and, in behalf of the board of health of which he is an executive officer, (*b*) to order the prompt and thorough isolation of those sick or infected with such disease, so long as there is danger of their communicating the disease to other persons; (*c*) to see that no person suffers for lack of nurses or other necessaries because of isolation for the public good; (*d*) to give public notice of infected places by placard on the premises, and otherwise if necessary; (*e*) to promptly notify teachers or superintendents of schools concerning families in which are contagious diseases; (*f*) to supervise funerals of persons dead from scarlet-fever; (*g*) to disinfect rooms, clothing, and premises, and all articles likely to be infected, before allowing their use by persons other than those in isolation; (*h*) to keep the president of his

[1] In cities so large that this work cannot be done by the health-officer, a sufficient number of experts should be employed in this work.

own board of health, and the secretary of the State board of health, constantly informed respecting every outbreak of scarlet-fever, and of the facts, so far as the same shall come to his knowledge, respecting sources of danger of any such diseased person or infected article being brought into or taken out of the township, city, or village of which he is the health-officer.

The spread of scarlet-fever can generally be prevented by the plan of prompt notification, thorough isolation, and complete disinfection of all infected substances. But when this plan has come into general operation, there is needed a plan for the prevention of the introduction of the disease from without the jurisdiction. Quarantine officers should be required to be as watchful and strict to prevent the introduction of scarlet-fever as of small-pox, because the loss of life by scarlet-fever is many times greater than by small-pox. For results of perfect and of imperfect compliance with this plan, see the diagram (A) presented herewith; see also Proceedings of Michigan State Board of Health, January, 1887, where it is shown that there was a probable saving of 3,718 lives from this one disease in the first eleven years after the adoption of this plan by the Michigan State Board of Health.

Probably much may be done to prevent well persons from contracting scarlet-fever when they are exposed to it. Statistics seem to prove that the rise and fall of this disease are controlled by the temperature and humidity of the atmosphere; scarlet-fever rising after the temperature falls, and falling after it rises. The reasons why are stated in Dr. Baker's paper on 'Some of the Cold Weather Communicable Diseases' (with diagrams), in the Transactions of the Michigan State Medical Society, 1887.

A very great number of reports have been received by the Michigan State Board of Health from reliable physicians, stating facts which show that scarlet-fever is conveyed by "direct communication," "exposure while visiting," etc.

The following statements are taken from the reports of the health-officers to the Michigan State Board of Health, showing that scarlet-fever may be conveyed by clothing, etc., and after a long period of time has elapsed since the first case occurred (with the name of health-officer and locality subjoined): —

"A man living in Detroit who has a child living in this neighborhood came to see her, and in a short time the little girl was sick of scarlet-fever. It was ascertained that he had been living with a family who were afflicted with the same." — Dr. S. Holcomb, health-officer, Southfield Township, Oakland County.

"By the presentation of the dress of a little girl who died at Jackson to a little girl living here." — Dr. Samuel DuBoise, Unadilla Township, Livingston County.

"A woman brought the disease from Canada in her clothing, and gave it to the children where she staid. Case No. 1 took it then, and case No. 2 took it from the children at school." — E. F. Wood, health-officer, Isabella Township, Isabella County.

"The only source of contagium that I have been able to discover was through letters received from a family residing in Mount Pleasant, which was then affected with it." — Dr. J. P. Cooper, health-officer, Ithaca Township, Gratiot County.

"I have but one case of contagious disease to report this week, that of Miss N. F., age seven years. The source of contagium is peculiar. Miss G. H., of Grass Lake, Jackson County, Mich., sick with scarlet-fever, wrote a letter to the mother of this patient, and she (the little girl) had the envelope in her mouth. Seven days later she came down with the disease. It seems certain that she contracted the disease in that manner, as there is no other way that I can account for the appearance of the disease in that part of the township." — Dr. H. C. Maynard, health-officer, Hartford Village, Van Buren County.

"Last June one of Mr. More's children had scarlet-fever. Strange to relate, but one of them had it. The 10th of this month [November] the carpets were taken up, and Fannie, and Lulu, a cousin living near by, romped and played on them while in the yard. In a little over a week both of them were taken sick with scarlet-fever. No precautions were taken after the case had occurred last June, and hence the outbreak nearly four months afterwards." — Dr. M. E. Bishop, health-officer, South Haven Village, Van Buren County.

The 'Report of the Michigan State Board of Health for 1884' contains, on p. 276, the following accounts of methods of spread of scarlet-fever: —

Dr. A. L. Ambrose, health-officer of Hanover Township, Jackson County, reported three cases of scarlet-fever where the source of contagium was a washtub which had been used several weeks previously by a family having the scarlet-fever. In four cases the contagium was left in houses that had not been properly disinfected. In one case the germs of the disease remained in the bedding that had been used by a scarlet-fever patient six or seven months previously. In one case the disease was taken from "old rags of eighteen to twenty months' standing."

Nov. 19, Dr. N. W. Andrews, health-officer of North Muskegon, writes, "There was, some six or eight months ago, a mild case of scarlet-fever in the adjoining house: at the time, the people who now have the case had some household furniture stored there, which has lately been moved into their own house. I can find no other cause for the outbreak than that the contagium was communicated by means of the tapestry, which had been stored in a room where the child when sick had been allowed to go."

The following interesting statements are extracts from a letter received Aug. 23, 1884, from Rev. Fayette Hurd of Grand Blanc, Mich., giving facts concerning scarlet-fever near the village of Laingsburg, Shiawassee County, during the month of December, 1880: —

"About Dec. 20, 1880, the family were in the garret of the house, gathering up rubbish that had been collecting there for some time. They put into a basket to be burned a number of magazines, pictures, pieces of cloth, window-curtains, carpet-rags, and an old rubber doll, which belonged to a family that had the scarlet-fever in the same house during the winter of 1874–75. The boys gathered up a good many of the pictures, and the girl took the doll, which belonged to the child who had the disease in 1874, and was, I think, used by her when sick with scarlet-fever. The curtains were hung in the windows of the room during the sickness in 1874–75.

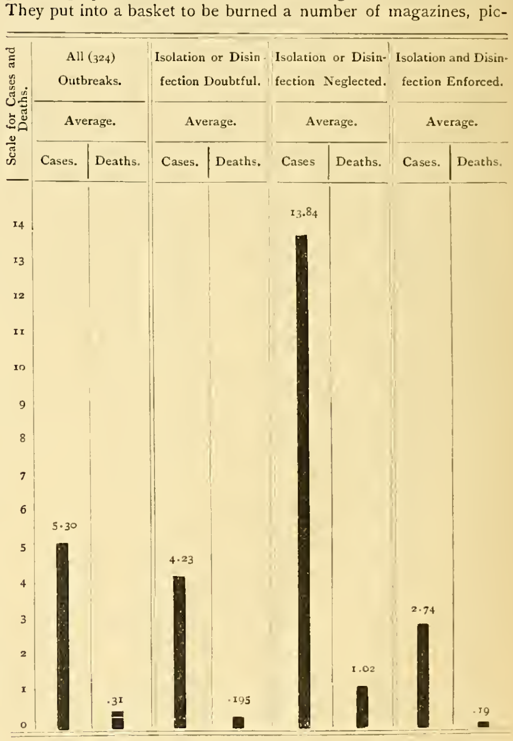

DIAGRAM A.

The things saved out were used by the children for two or three days. The rest of the rubbish was burned. Near the last of December the three children were taken sick with scarlet-fever."

The diagram (A) exhibits in a condensed form the experiences of the health-officers in Michigan relating to scarlet-fever during the year 1886. It shows, that, in the 324 outbreaks, the average number of cases was 5.30, and the deaths were .31 ; that in the 45 outbreaks in which isolation or disinfection, or both, were neglected, the average number of cases was 13.84, and the deaths 1.02 ; that in the 58 outbreaks in which isolation and disinfection were both enforced, the average number of cases was only 2.74, and the average number of deaths .19, the difference being an average of 11.10, and .83 deaths, indicating a saving in these 58 outbreaks of 644 cases and 48 deaths. This saving is shown not simply by comparison with those outbreaks in which nothing was done, but also with outbreaks in which either isolation or disinfection was enforced.

A table (compiled in the office of the secretary of the State board of health, from reports made by local health-officers) giving the basis for the diagram and foregoing statement is as follows : —

SCARLET-FEVER IN MICHIGAN IN 1886.

	(1) All Outbreaks. (324 Outbreaks.)		(2) Isolation or Disinfection not mentioned, or Statements Doubtful. (220 Outbreaks.)		(3) Isolation or Disinfection, or Both, Neglected. (45 Outbreaks.)		(4) Isolation and Disinfection Both Enforced. (59 Outbreaks.)	
	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.
Totals....	1,716	100	914	41	623	46	179	13
Averages.	5.30	0.31	4.15	0.19	13.84	1.02	3.03	0.22

BOOK-REVIEWS.

Geology, Chemical, Physical, and Stratigraphical. Vol. II. By JOSEPH PRESTWICH. Oxford, Clarendon Pr. 8°.

THE present volume of Prestwich's 'Geology' treats of stratigraphy and physical geology, — the history of the earth as traced from the study of strata and fossils. In the first volume of this great work, which appeared in 1886, the composition of rocks, and the changes brought about in them by the various meteorological agencies on the surface, and by thermal and chemical action at depths, were discussed, and the nature of the disturbances which the rocks have undergone by the action of subterranean agencies, the elevation of mountain-chains, and the manner of volcanic action, were described. This discussion of dynamic geology is now followed by a geological history. As the handbook is mainly intended for use in Europe, the geological history of Europe, more especially that of Great Britain, is treated more fully than that of other countries ; but the author, after having described the geological history of a period in Great Britain, gives a sketch of the contemporaneous course of events in other parts of the world.

The volume deals naturally with two classes of geological data, — paleontological and physiographical. The description of the evolution of life in the various periods and areas is profusely illustrated by carefully selected illustrations, part of which are printed in the text, while others are shown on lithographed plates. The cuts show the characteristic classes and orders which are peculiar to the greater divisions, while the plates show characteristic genera of each group. In discussing the lesser divisions of formations, figures representing important species are inserted in the text. By this arrangement of illustrations, and by a careful choice of the best among the available material, the author has succeeded in making the volume very instructive and useful to the student. He dwells at some length on the results of recent discoveries, and on the important part played by sponges and foraminifera in building up certain sedimentary strata. The relation of the globigerina ooze of the deep seas to the chalk is fully discussed ; and the author shows that the physical conditions of the deep sea of the present time, with its cold polar water, and those of the cretaceous sea, which was probably not so deep, and certainly not so cold, were so different that their deposits must necessarily be different. He compares the chemical and physical composition of the chalks to that of the globigerina ooze, and shows that the former is far purer than the latter, and that no equivalent deposit is forming at the present time. "The conditions under which it was deposited were peculiar and special ; and, though it presents many points of analogy to the calcareous ooze, there are none of identity ; and the chalk stands alone among the British strata in its peculiar structure and origin. It is for these reasons that I have taken the opportunity of making the foregoing remarks, not because the chalk forms an exception to the general rule of constant change, but because its features are so clear and so well marked that it serves better than most other deposits to illustrate this law of unceasing variation."

The range of genera and species of the same period through space is also briefly described. The geophysical problems which geological history has to treat are wisely confined to the concluding chapters, where the student will find the most important theories held by physicists discussed, so far as they can be proved or refuted by geological data. The author himself advocates the theory of a thin crust, a solid nucleus, and a viscous magma between the two, as he believes that the motions of the earth's crust can only be explained by such a theory.

The volume has a very full index. and is accompanied by a geological map of Europe compiled by William Topley and T. G. Goodchild. The colors adopted resemble, for the most part, those proposed by the International Geological Congress, with the exception of the Trias, Permian, and Siluro-Cambrian, for which the tints more familiar to English geologists were retained.

NOTES AND NEWS.

ABOUT one hundred and fifty scientific men and women of Washington gathered in the hall of the Columbian University on the evening of Thursday, April 5, to pay their tributes to the memory of Dr. Asa Gray, the eminent botanist, and to listen to addresses by several of his intimate friends and co-workers. The president of the meeting was Professor Langley, secretary of the Smithsonian Institution, who opened the exercises with a brief tribute to the memory of Dr. Gray. Professor Chickering delivered the first address, giving a sketch of the life and life-work of Dr. Gray, tracing the gradual unfolding from the pioneer's life of boyhood to the finished scholar and true scientist of middle and later life. The world is indebted to him, he said, for popularizing botany. He put into plain English that which interested people. He had a genius for work. Work was a delight. He was never in a hurry. He had time for social enjoyment with his friends, as well as for investigation and the preparation of a great number of books. He conducted a very large correspondence, but he economized time and labor even in this. He often returned a letter containing a great number of questions with simply 'yes' or 'no' written at the bottom of each. Professor Chickering also spoke of the honors that had been heaped upon him. He was a member of the Royal Society of London, and, of the Institute of France, one of the eight immortal foreign members. Professor Chickering spoke of the last year of his life as the happiest, and closed with an eloquent tribute to his memory. Dr. Vasey of the Agricultural Department spoke of the influence Dr. Gray exerted upon botanical science. He began with a review of the state of botanical knowledge before his time, spoke of his studies under Dr. Torrey in New York, of his botanical text-books, and of his investigations of the collections made by the government and by private individuals. He spoke in detail of his work ; said that during his lifetime the number of known botanical species upon the continent of North America had increased from 4,081 to more than 11,000, and the number of volumes of his school-books published was more than half a million. Prof. L. F. Ward of the National Museum spoke of Dr. Gray's relations to the discovery of the theory of evolution, showing that Mr. Darwin had the greatest confidence in him, and intrusted to him, almost before he did to any other, the secret of his great discovery. Dr. Gray was one of the first to understand and appreciate the importance of Mr. Darwin's work, and did more than any other to make it acceptable to American thinkers. Professor Ward's address, like every thing that he writes, was very compact, and showed an intimate acquaintance with the history of the struggle of the doctrine of evolution for recognition in this country, and of the honorable part Dr. Gray took in it. Dr. C. V. Riley, who was the last speaker, dealt with Dr. Gray as a man. His address was an eloquent tribute to the memory of one of the most delightful men he had ever known, and its interest was heightened by the relation of circumstances connected with Dr. Gray's visit to Europe last summer. Especially touching was his description of Dr. Gray's reception in the meeting of the British Association for the Advancement of Science. Dr. Gray, who was one of the regents of the Smithsonian Institution, had many very close friends among the scientific men of Washington, who mourn him more as a father or a brother than as a fellow-worker in the field of science.

— Captain van Gèle has at last succeeded in solving the problem of the Welle. A telegram sent by Mr. Janssen, governor of the Kongo Free State, on March 15, and published in the *Mouvement géographique*, announces that the Obangi above the rapids of Zongo flows from east to west between 4° and 5° north latitude. Captain van Gèle ascended the river as far as 22° east of Greenwich, and ascertained its identity with the Welle-Makua of Schweinfurth and Junker. Captain van Gèle, after thus having solved the much-discussed problem of the Welle, returned, and reached Leopoldville in safety. It will be remembered that Captain van Gèle, after Junker's discoveries had become known, was put in charge of the exploration of the Welle. On his first expedition, which was made at the high-water season, he was unable to pass the rapids of Zongo. Later on, he made an attempt to reach Junker's Ali-Kobbo from the Itimbiri; but, on account of scarcity of supplies and the density of the woods, he was unable to carry out his plan. On Oct. 2, 1887, he started on his last expedition on the 'En Avant.' After a brief stay at Kwa-mouth, he began his ascent of the Obangi, accompanied by Lieutenants Liénart and Dhanis and a small detachment of soldiers. Junker's farthest point west on the Welle was 22° 55′ east from Greenwich. It would seem, therefore, that Captain van Gèle approached this point to within a distance of about sixty miles. The *Mouvement géographique* announces, besides the death of Captain vande Velde, chief of the military expedition to Stanley Falls, — not the explorer of the Obangi, as was erroneously stated in *Science* of March 30, — that of Lieutenant Warlomont, second in command at Boma. This is a serious loss for the Kongo Free State, which had of late been very fortunate, so far as the health of its employees was concerned.

— In a review of Chamberlain's 'Catalogue of Canadian Birds,' it was said that the addition of a systematic table would have greatly enhanced the value of the work. This table has been published by the author under the title 'A Systematic Table of Canadian Birds' (St. John, N.B., published for the author). The table, which contains 551 species belonging to 236 genera, 55 families, and 15 orders, is very clear, presenting at once a table of the higher groups, and a check-list of the birds that are found within the boundaries of the Dominion. Students of American ornithology will be glad to read the author's announcement in the preface, that his promised 'Bibliography of Canadian Ornithology' is well under way, and will probably be published during the coming summer.

LETTERS TO THE EDITOR.

Volapuk : Is it Difficult ?

HERE is a subject pronounced difficult to learn ; yet the learners are unaware of the difficulty. Is not this an anomaly ? It is like the considerate Irish father who proposed to surprise his son with a birthday gift by having him taught the violin 'unbeknownst.' Professor March and Mr. Melville Bell, to whom the learning of strange tongues is a mere pastime, pronounce Volapük too highly inflected, not for themselves, but for the English-speaking masses. But the American business-man, snatching an hour or two in the evenings, somehow or other manages to surmount the obstacle which the professors declare insurmountable, and after a week writes grammatical Volapük. Possibly, had he known that such high authority had declared the feat impossible, he would, with his well-known modesty, have refrained from a practical contradiction of their dicta.

But do not these philologists (both of whom I greatly admire and respect) unconsciously exaggerate the difficulty of inflected language? Is it not simply that the inflected languages which they learned as boys, and which they have seen other boys toiling over ever since, had got into a state of anomaly and chaotic irregularity? It seems to me, from what I have learned by reading the works of these and other eminent philologists, that the crushing-off of terminations which finally happens, is a protest against their lawlessness. I say this with deference and in quotation-marks. Is it not a fact that terminations, when regular, are retained, not destroyed? There is no indication that we or the Spaniards are likely to drop the convenient and nearly regular plural-sign *s*, and denote plurality by a separate word or not at all. We have, it is true, lost a great many terminations *-en*, and the Germans are doing the same in speech; but that is of a converse kind of irregularity. Instead of many forms for one thing, *-en* had too many functions : it died of overwork.

Mr. Bell thinks we "may safely assume that the universal language to be some time adopted will express all verbal relations by separate words, and not by root-inflections." Then Chinese is the type of the coming language. Are its methods easy even in the colloquial tongue? Missionaries say not: I do not know.

Mr. Bell's transformation would result in this, for example, retaining the Volapük syllables : to express 'of the man,' 'of the time,' 'of the form,' 'of the staff,' 'of the stone,' where we now say *mana, tima, foma, stafa, stona*, the new reading would be *a man, a tim, a fom, a staf, a ston*. *Tima*, in one word, comes under the head of 'Case-Endings and Other Grammatical Subtleties :' *a tim*, in two words, is simple, and devoid of subtlety. What a wonderful change is wrought by the printer's space!

I could sincerely wish, with Mr. Bell, that there were an alphabet in use, not only for Volapük, but for all languages, which should be "easily and uniformly intelligible to all readers." Mr. Bell's marvellously perfect alphabet, 'Visible Speech,' would answer the description; but it would have been folly to use it for Volapük until adopted for national languages. The Roman alphabet is the international alphabet at present, and Schleyer acted wisely in keeping it. In so far as he deviated from it by his use of the un-Roman *ä, ö, ü*, and his un-Roman sounds of some consonants, in so far he is at fault. His principle was right. It is the associations of our barbarous English spelling which make us mispronounce new words like Volapük. If the English *o* had not double duty to perform, we should unerringly begin the word like '*vo*cal,' not like '*vol*ume.' Some of us spelling-reformers hope some day to restrict *o* to its proper function.

Bishop Wilkins's 'Real Character' (by which he does *not* mean 'phonetic representation'), and scores of other attempts at philosophical language based on classification of ideas, have failed (in spite of the genius of at least the first named) to come into practical use. Volapük has been learned by more persons, I believe, and more used in printing and writing, than all the others put together. There must be a reason for this, which I call upon the theoretical objectors to explain. An imperfect mechanism which actually works is better than a most scientific motor which 'motes' not.

In counting up the words which are like their English prototypes, Mr. Bell has omitted such as these: *tim* (time), *fom* (form), *spid* (speed), *sid* (seed), *skil* (skill [the Philological Society of London spells it 'skil']), *slet* (slate), *slip* (sleep), *smok* (smoke), *snek* (snake), *silab* (syllable). I have picked up most of these within a page.

Well, I suppose the unlearned man wll go on acquiring this difficult language easily: the masses *will* do things wrong. Half a dozen will write me letters this coming week (just half a dozen did last week) to show me what they have accomplished in a few days.

On the other hand, I have some choice specimens of educated foreigners' English which are conclusive evidence, I think, that our "simple," "grammarless," "uninflected," "analytic" language contains some fearful pitfalls for the unwary.

I read a good deal about English being or becoming the "universal language," but what I read to that purport is never written by Frenchmen or Germans or Italians, somehow or other. This is strange, isn't it? CHARLES E. SPRAGUE.

New York, March 31.

BOOK-NOTES.

— Messrs. Ticknor & Co. announced for publication on Saturday, April 7, 'Ancient Legends of Ireland,' by Lady Wilde ('Speranza'), with a chapter on the ancient races of Ireland by the late Sir William Wilde, new and cheaper edition; and 'Literary Landmarks of London,' by Laurence Hutton, fourth edition.

Calendar of Societies.

Biological Society, Washington.

April 7. — J. W. Collins, The Work of the Schooner 'Grampus' in Fish-Culture; Charles D. Walcott, Cambrian Fossils from Mount Stephens, North-west Territory of Canada; C. V. Riley, Some Notes from Emin Pacha's Travels in Central Africa; Theobald Smith, The Destruction of Pathogenic Bacteria in the Animal Organism.

Anthropological Society, Washington.

April 3. — H. L. Reynolds, Algonkin Metal Smiths; Jeremiah Curtin, Mythology and Modoc Myths.

Engineers' Club, Philadelphia.

March 17. — A. Marichal, Testing of Cements; Frederic H. Robinson, Manufacture of Gunpowder; J. W. Redway, Explosion of Gunpowder; L. F. Rondinella, Incandescent Electric Lighting.

American Institute of Electrical Engineers, New York.

April 10. — John W. Howell, Maximum Efficiency of Incandescent Lamps.

Appalachian Mountain Club, Boston.

April 11. — Henry Ballantine, A Trip to Nepal through the Himalayas; R. B. Lawrence, George H. Witherle's Exploring Trips, in 1884–86, to Ktaadn, the Sourdnahunk Mountains, and the Region between.

Missouri State University Club.

April 2. — C. G. Tiedemann, The Modern Phase of Natural Rights.

Engineers' Club, St. Louis.

April 4. — Willard Beahan, Railroad Location; Field Practice in the West; Professor Nipher, Heat Value of Fuels.

Publications received at Editor's Office, April 2–7.

BLACKWELL, J. S. A Manual of German Prefixes and Suffixes. New York, Holt. 137 p. 16°.
HUGHES, A. Geography for Schools. Part I. Practical Geography. Oxford, Clarendon Pr. 71 p. 12°. (New York, Macmillan, 60 cents.)
INGE, W. R. Society in Rome under the Cæsars. New York, Scribner. 276 p. 16°. $1.25.
INGRAM, J. K. A History of Political Economy. New York, Macmillan. 250 p. 12°. $1.50.
MCANALLY, D. R., jun. Irish Wonders. Boston and New York, Houghton, Mifflin, & Co. 218 p. 12°. $2.
MACCORD, C. W. Practical Hints for Draughtsmen. New York, Wiley. 100 p. 4°. $2.50.
MOUTONNIER, C. Pour Apprendre à Parler Français. New York, Holt. 191 p. 12°.
NEW JERSEY, Annual Report of the State Geologist of, for the Year 1887. Trenton, State. 45 p. 8°.
ROLLESTON, G. Forms of Animal Life. 2d ed., revised by W. Hatchett Jackson. Oxford, Clarendon Pr. (New York, Macmillan, $9.)
STUCKENBERG, J. H. W. Introduction to the Study of Philosophy. New York, A. C. Armstrong & Son. 422 p. 8°. $2.
STURDY OAK, The. Vol. I. No. 1. April, 1888. *m.* Boston, W. A. Sturdy. 16 p. f°.

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SCIENCE

FRIDAY, APRIL 20, 1888.

HUNDREDS OF REPORTS have been received at the Hydrographic Office of the Navy Department from vessels that experienced the storm of March 11–15, more than seventy of them from vessels that were immediately off the coast of the United States. An interesting feature of these latter is the descriptions of the use of oil to calm the waves. More than a dozen captains and sailing-masters caught in the storm when it was at its worst say that they believe that their vessels were saved by it. The sailing-master of the yacht 'Iroquois' says that the furious waves would be coming down upon them with an immense comb, threatening to swamp them; but, when it encountered a patch of oil no larger than a dining-room table, its top would be rounded, and there would not be even a wind-ripple upon it, and the yacht would bob over it like a gull. The reports of the storm have brought no new facts in regard to the use of oil to still the waves, but they confirm the opinions heretofore held, and will undoubtedly lead to its more frequent employment. The great service which the Hydrographic Office has rendered to navigation in this regard is now recognized in all maritime countries. Only lately, Capt. W. J. L. Wharton, R.N., hydrographer to the British Admiralty, in *Nature*, began an article by saying that the employment of oil by the ships of all countries was due to the efforts of the United States Hydrographic Office in forcing the subject upon the attention of navigators. Similar testimony has been given by high officers of the French Navy in recent publications.

THE PHILADELPHIA *Press*, in commenting upon some recent remarks of *Science* touching the wastefulness caused by the delays in printing scientific reports of the government, remarks that good editors are needed in Washington as much as more printers and better management of the Government Printing-Office. This is true, and the remark is applicable to all other bureaus and departments as well as those engaged in scientific work. Scarcely a volume is published by the government that would not be greatly improved by condensation. Examples are hardly necessary for those who are in the habit of looking over government publications, but one or two may be given in illustration. Congress has just ordered an extra edition of twenty-five thousand copies of a report on 'Cattle and Dairy Farming,' made by the consuls of the United States abroad, of which the original edition has been exhausted, and for which there has been much call by the cattle-raisers and dairy-farmers of the United States. It comprises two volumes, together containing 855 pages of letterpress, besides 369 full-page lithographic engravings. The book contains a large amount of very valuable information that can be obtained nowhere else; but, if it had been edited only to the extent of cutting out nothing but duplications, the dimensions of the book might have been reduced one-half, and its value greatly increased. In many instances several consuls in the same country went over the same ground, and sometimes obtained their information from the same sources. The best of these reports ought to have been selected for publication in full, and only the additional matter contained in the others added in carefully selected extracts. But instead of doing this, the State Department put the reports and enclosures all in, in full, and thus made a book that is likely to frighten a farmer by its very size. Another example of enormous waste in printing, to say nothing of the doubtful expediency of preparing the matter, is to be seen in a 'Report upon an Examination of Wools and other Animals,' by Dr. McMurtrie, prepared under the direction of the commissioner of agriculture. It is a quarto book of more than 600 pages, about 100 of which are filled with letterpress and illustrations, and 500 with solid tables of figures. One of these, filling 32 pages, is a 'Table for Reduction of Centimillimetres to Fractions of an Inch.' No printer will have to be told how expensive this rule-and-figure work, with its 21 columns to a page, is. Another, filling 102 pages with solid figures, gives the 'Results of Actual Measurements of Length, Crimp, and Fineness, with Recapitulations and Reductions.' And so on for 500 pages. Now, if it was necessary to make all these measurements, it certainly was not necessary to print them. The results of them are set forth in the body of the report, and these are all practical men want. If a scientific man desired to see all the figures made to obtain these results, he could go to the files of the Agricultural Department and examine them there. An octavo volume of 200 pages would have contained all that it was necessary to print, and would not have cost, with illustrations, more than one-fourth as much. The government needs an editor.

THE WORK upon the marble terrace which is to surround the Capitol at Washington on three sides is nearly completed, and the effect of it upon the architectural appearance of the building can now be seen. From any point on Pennsylvania Avenue between the Treasury Department and the western entrance to the Capitol grounds, the effect is unquestionably pleasing. The terrace will appear as though it was the foundation of the building, thus making it seem to be decidedly higher, and relieving it of that 'squatty' appearance which has always offended the eyes of those who have an appreciation of proper proportions in a grand structure. Viewed from a distant point either on the north, south, or west, therefore, this marble terrace seems to be an architectural success. But, as soon as one enters the west Capitol park and approaches the building, he discovers that this so-called improvement, expensive as it has been, is a blemish rather than an embellishment of the Capitol. Long before reaching the foot of the grand stairway, the marble terrace not only ceases to appear as a part of the building, but hides a part of its beautiful front. At the Marshall statue the upper edge of it is projected against the marble columns of the two wings of the Capitol halfway from their bases to their capitals, and from many parts of the grounds on the west they greatly disfigure the noble structure. It is just as important that the proportions of the Capitol shall appear to be correct when viewed from a point that is near as from one that is removed; but the architect seems to have supposed, that, when a person has once entered the grounds from the west, he will be so much impressed with the grand marble stairway that he will not raise his eyes to the building to which they lead.

THE PLAN OF ESTABLISHING a zoölogical garden in Boston, which has been pending for twenty-one years, seems to lead at last to practical results. The council of the Boston Society of Natural History has taken the matter in hand. It gained the co-operation of the park commissioners, who offered two separate sites for the garden. The society proposes to make the enterprise thoroughly educational. In view of the climate of New England, no attempt will be made to make the garden of so general a nature as they are made in Europe. It will be rather an effort to show specimens of American animals, especially those of New England. Finally it was resolved to make an attempt to raise a sum of $200,000, and then to proceed with the establishment of a garden and aquaria. The energetic efforts of the committee will undoubtedly succeed in arousing a general interest in the matter and in raising the necessary funds. The educational value of a garden like the one proposed can hardly be overestimated, as it affords to the inhabitants of the city those advantages which, as a rule, only those living in the country enjoy.

THE AMERICAN PHILOSOPHICAL SOCIETY has paid considerable attention to the subject of a universal language; and on Oct. 21, 1887, a committee was appointed, of which Prof. D. G. Brinton was chairman, to examine into the scientific value of Volapük. The committee recently presented its report, and the society adopted the following resolution: "That the president of the American Philosophical Society be requested to address a letter to all learned bodies with which this society is in official relations, and to such other societies and individuals as he may deem proper, asking their co-operation in perfecting a language for learned and commercial purposes, based on the Aryan vocabulary and grammar in their simplest forms; and to that end proposing an International Congress, the first meeting of which shall be held in London or Paris." The introductory remarks to the report of the committee, referring to the desirability of an international scientific terminology, will be approved by all scientists; but many will rather join Max Müller's appeal to the learned writers of the world to express themselves in English, German, French, Spanish, Italian, or Latin, than support the plan of establishing a new universal language. The proposals of the committee are founded on the process of formation of jargons. Grammatical forms are eliminated, and the order of words determines the meaning of the sentence. The phonetics are to be simple, and the vocabulary based on the vocabulary which is common to the leading Aryan tongues. As Volapük and other universal languages are not formed according to these principles, the committee considers them as not apt to meet the requirements of international intercourse. All this may be true, but it would seem to us that scientists, even if successful in the attempt at forming an artificial language which would be as well adapted for thinking as for writing and speaking, would increase the amount of necessary work instead of diminishing it. Before the era of nationalities, as we may well designate our time, English, German, French, and Spanish were almost exclusively used in scientific publications of any importance. The same feeling that prompted writers to use their own language, however few the men speaking it may be, will prevent the general adoption of a universal language; and when this feeling has subsided, those few European languages will again become the means of scientific intercourse. And how should we make use of the treasures contained in the literature of the past, or in popular writing, without learning these languages? We believe that these difficulties, even aside from that of making a satisfactory language, will prevent the scheme of a universal language being successful.

YUKON EXPEDITION, 1887.

WE noticed several times the progress of the Yukon expedition undertaken by the Canadian Government in 1887. The present number of *Science* is accompanied by a map showing the results of this important expedition. The map is a reduction of a large-scale map published by the Department of the Interior of Canada, a number of corrections being added by Dr. Dawson. The coast-line is founded upon the charts of the Coast Survey. While the greater part of the topography of the interior is the result of last year's expedition, a few older explorations were available for constructing the map. The lower part of the Stikine River was surveyed in 1877 by J. Hunter. The traverse from Telegraph Creek down the Hotalinqua River, to latitude 60° north, was made by the Telegraph Exploration in 1867. Schwatka's maps were used for constructing the lower part of Pelly River, while Chilkat River is founded on Dr. A. Krause's surveys in 1882.

The recent expedition was undertaken in consequence of the necessity of ascertaining the nature and extent of the developments of placer gold-mining, which of late years has attracted an increasing number of miners into that part of the North-west Territories lying between British Columbia and Alaska. We reported in No. 243 of *Science* on the progress of Dr. Dawson's expedition up to the 29th of July. Mr. William Ogilvie had reached the lower part of Pelly River by a different route. He had started from Chilkoot Inlet, and reached the summit of Chilkoot Pass on June 8. On June 27, after considerable difficulty occasioned by stormy weather, the first lake was reached. Mr. Ogilvie experienced considerable difficulty in carrying his instrumental survey across the mountains. He says in his report to Captain Deville, "Beginning from the summit of Chilkoot Pass, we descend almost one-third of a mile to Crater Lake, the fall in that distance being by barometer 367 feet. At four miles and a half from the summit, Mountain Lake, which is about a mile and a half in length, is reached, the fall in this distance being about 575 feet. At this point the first trees on the north-east side of the summit are seen, but they are of no importance, being small and of stunted growth." Lake Lindeman was found to be 1,237 feet below Chilkoot Pass. The party then crossed Lake Bennett and Lake Marsh, and began their descent of the Lewes River. "At 125 miles from salt water, the cañon is reached. At this point the river flows through a fissure in a barrier of basaltic rocks which intersects its course. The cañon proper is about five-eighths of a mile long and about 100 feet wide, with perpendicular walls from 60 to 80 feet high. The current through it is swift and the water rough; but, with a fairly large boat, the only risk in running through it would be from contact with the sides, in which case one would be certain to come to grief. The passage through it is made in from three to four minutes. The cañon and its rapids are altogether two miles and three-quarters long. The last rapid, which is three-eighths of a mile in length, is a bad one, and we had to portage every thing round it, and let our boat down with ropes from the shore. This rapid is called by the miners the 'White Horse,' from the fact that nearly all the water is white with foam. Several parties have run through the rapid on rafts, and one or two in boats, but few want to repeat the trip." In proceeding farther down the river, the travellers passed Big Salmon River. Looking up its valley, a distant view was had of many mountain-peaks covered with snow, the presence of which in summer is proof of a considerable altitude. Ogilvie found that the upper part of the river was almost deserted by the miners, who have gone to Forty-Mile Creek, where considerable quantities of gold have been found.

Dr. Dawson, who had reached the Pelly River by way of the Stikine and Frances Lakes, describes the latter part of his journey as follows: "Our Indians, who had for a long time been very uneasy because of their distance from the coast and the unknown character of the country into which they had been taken, were now paid off, and, to their great delight, allowed to turn back. As a dangerous rapid was reported to exist on the upper part of the Pelly, it was decided to construct a canvas canoe in preference to building a boat, which it might prove impossible to portage past the rapid. Having completed the canoe, we descended the Pelly, making a portage of half a mile past Hoole's Rapid, and reached the confluence of the Lewes branch of the Pelly on the 11th of August. We had now reached the line of route which is used by the miners, and expected to find at the mouth of the Lewes a memorandum from Mr. Ogilvie, from whom we had separated in May. As we could not find any such memorandum, and as Mr. Ogilvie had not been seen on the lower river by a party of miners whom we met here on their way up the Lewes, we were forced to conclude that he had not yet reached this point. The same party informed us that few miners were during the summer on the Stewart River, where most of the work had been carried on in 1886, but that in consequence of the discovery of 'coarse' gold on Forty-Mile Creek, about 120 miles farther down the river, all had gone there, and that Harper's trading-post, where I had hoped to be able to get an additional supply of provisions should we fail to connect with Mr. Ogilvie, had also been moved from the mouth of the Stewart to Forty-Mile Creek. From the place where we now were, we still had a journey of over 400 miles to the coast, with the swift waters of the Lewes to contend against for most of the distance. If, therefore, it should have become necessary to go down stream 220 miles to Forty-Mile Creek for provisions, so much would have been added to our up-stream journey that it would become doubtful whether we should be able to afford time for geological work on the Lewes, and reach the coast before the smaller lakes near the mountains were frozen over. I therefore decided to set about the building of another boat, suitable for the ascent of the Lewes, and on the second day after we had begun work Mr. Ogilvie very opportunely appeared. After having completed our boat and obtained Mr. Ogilvie's preliminary report and survey sheets, together with the necessary provisions, we began the ascent of the Lewes, from the head waters of which we crossed the mountains by the Chilkoot Pass, and reached the coast at the head of Lynn Canal on the 20th of September. I am happy to be able to add that the entire expedition was carried out without any serious accident or loss, notwithstanding the difficult nature of the country, and that, though circumstantial reports were heard in the spring, of trouble between the miners and Indians on the Yukon, these proved to be entirely groundless."

Mr. Ogilvie proceeded down the Pelly River, and is now wintering in the vicinity of Belle Isle. It was proposed to make astronomical observations corresponding to those of Mr. Ogilvie near the point of intersection of the Yukon and 141st meridian at two places, — Kamloops and Ottawa. Unfortunately the corresponding observations could not be carried out, and the value of Mr. Ogilvie's astronomical work is therefore problematical. This spring he will start for the mouth of the Mackenzie by way of the Porcupine River and Fort Macpherson, and ascend the Mackenzie to Fort Chipewayan, connecting with his own survey of the Peace and Athabasca Rivers.

THE GEOLOGICAL OBSERVATIONS OF THE YUKON EXPEDITION, 1887.

THE routes to be followed by the expedition were selected with the purpose of obtaining as much information of a geographical, geological, and general character as possible of the great tract of country included in the extreme northern part of British Columbia, and to the north of the 60th parallel (which forms the boundary-line of that province), between the Rocky Mountains proper on the east, and the borders of Alaska on the west. The greater part of this vast region is drained by several large tributaries of the Yukon River, but these interlock to the south with tributaries of the Stikine and with branches of the Liard, a feeder of the Mackenzie.

The results obtained will form the subject of a detailed report of the Geological Survey of Canada, but for the preparation of this some time is yet required; and Mr. Ogilvie of the Dominion Lands Branch, and Mr. McConnell of the Geological Survey, are still in the field for the purpose of continuing surveys and explorations next summer. Meanwhile the following notes, bearing particularly on the principal geological features of scientific importance, may prove of interest.

In 1879 a geological traverse was made by the writer, of the entire width of the Cordillera region, by the line of the Skeena and Peace Rivers (*Report of Progress of the Geological Survey of Canada*, 1879–80); but this had, so far, remained the most northern line of geological examination across the wide mountain-belt of the west coast of the continent. The work of the past summer included a similar traverse of the same belt by the Stikine, Dease, and Liard Rivers, at a minimum distance of two hundred miles north of the last, and extended by the last-named river completely through the Rocky Mountains, to the great valley of the Mackenzie. The latter part of the traverse was, however, undertaken by Mr. McConnell, and his observations are not yet available.

To the north of this cross-section the exploration extended in the Yukon basin to the mouth of the Lewes River, near the 63d parallel. The actual line of travel and survey followed the Liard from its junction with the Dease northward to its sources, crossed the height of land to the Pelly near its head waters, followed that river down to the mouth of the Lewes, ascended the Lewes southward to its head, and finally, traversing the coast mountains by the Chilkoot Pass, reached the head of Lynn Channel.

The entire region thus examined may be described as mountainous in general character, though comprising also wide areas of hilly or rolling country, and many important flat-bottomed river-valleys. It declines as a whole gradually to the north-westward from heights of 2,730 feet at the Stikine-Dease watershed, and 3,150 feet at the height of land between the Liard and Pelly, to 1,550 feet at the confluence of the Lewes and Pelly. The close-set mountains forming the coast ranges on one hand, and on the other the serried peaks at the base of which Frances, Finlayson, and Pelly Lakes lie, and which represent the western tier of the Rocky Mountains, are here the principal mountain axes. A third important intermediate range, which it is proposed to name the Cassiar Range, is, however, cut through by the Dease River immediately to the east of Dease Lake. This appears to be continuous in a north-westward direction to the Pelly, after reaching which it assumes a more westward course, and with decreasing altitude follows parallel to the river, which it eventually crosses, near the mouth of the Lewes, in the form of low ranges of hills. The trend of the subsidiary and less continuous ranges to the west of the Rocky Mountains proper, as well as the prevailing strike of the rocks, partake in a similar general change in direction, wheeling westward in the north in approximate conformity with the outline of the Pacific coast.

The rocks throughout the entire region above outlined present close analogies to those already investigated in the southern portions of British Columbia, thus confirming previous statements with respect to the great general similarity, in a north-westerly and south-easterly direction, of the peculiar geological features of the Cordillera belt. The coast mountains where crossed by the Stikine, and again still farther north in the line of the Chilkoot Pass, consist for the most part of granitoid rocks, which are generally rich in hornblende and triclinic felspars. With these are occasionally included belts of crystalline schists, micaceous or hornblendic, the rocks as a whole resembling those of which details are given in my last report on Vancouver Island (*Annual Report of the Geological Survey*, 1886). It may be said, in fact, that the composition and structure of the coast ranges is practically identical wherever they have been examined, from the Fraser River to the head of Lynn Channel, — a length of nearly nine hundred miles.

To the east of these ranges, the country to and including the Rocky Mountains proper is chiefly characterized by the occurrence and wide distribution of paleozoic rocks, which often closely resemble those provisionally named the Câche Creek Series in southern British Columbia. They include limestones, quartzites, argillites, slates, and schists, with a notable proportion of agglomerates and other materials of volcanic origin, and are all pretty thoroughly altered and hardened and considerably flexed. Near Dease Lake, and again on the Pelly almost on the same line of strike, important beds of serpentine occur, and the associated rocks in these and many other places are preponderantly schistose and slaty, running through a number of varieties, but closely resembling the schistose and slaty rocks of Cariboo, and other gold-bearing districts to the south, and here also yielding gold.

These paleozoic rocks are interrupted by granitic areas, which generally rise in the form of ridges or mountain elevations, and were in some places observed to be flanked by more or less considerable occurrences of crystalline schists, which appear to be more highly altered portions of the paleozoic. The most important of these inland granitic ranges is that previously referred to as the Cassiar Range. Granitic mountains also, however, occur in the range to the east of Frances Lake, and elsewhere.

Fossils are by no means abundant in the paleozoic rocks; but a small collection of graptolites was obtained on the Dease, which has been submitted to Professor Lapworth, and by him pronounced to be of middle ordovician age, six species being recognized. This is, no doubt, the farthest north-western occurrence of a graptolitic fauna so far noted on the continent. Carboniferous fossils, notably *Fusulina* and *Loftusia Columbiana*, were obtained from limestones in the Liard basin, and again on Tahko or Tagish Lake near the head of the Lewes River. It is probable, however, that rocks ranging from the Cambrian to the top of the paleozoic, and possibly also including the triassic (Vancouver or Nicola Series), may be embraced in this great preponderantly paleozoic area.

Strata which are probably of cretaceous age occur on the Stikine in limited basins immediately to the east of the coast mountains; and rocks holding middle or lower cretaceous marine fossils have a considerable development on the Lewes, where they are associated with plant-bearing beds of the horizon (as determined by Sir W. Dawson) of the Laramie, or so-called miocene of the Mackenzie River and Alaskan coast. A few fossil plants, which are probably of cretaceous age, were also found at one place on the Pelly.

The miocene proper is represented in the upper Liard valley by soft stratified rocks associated with basalts; and basaltic flows of limited extent, and probably of the same age, occur on the Pelly, at the confluence of that river with the Lewes, on the latter river at the Cañon, and again in the Stikine valley east of the coast mountains. There is not, however, in the entire region examined, any wide basaltic plateau.

Some features of special scientific importance occur in connection with the superficial deposits and the evidences of glacial action, but these cannot be more than mentioned in this brief note. It may be stated, however, that true bowlder-clay is frequently seen in the river-sections, and generally passes up into and is covered by important white or gray silty deposits, resembling those of the Nechacco basin in British Columbia, and of the Peace River region to the east of the Rocky Mountains. These later-glacial silts are particularly wide-spread in the Upper Yukon basin. Terraces are generally conspicuous features in the landscape, and extend even to the higher parts of the district, while water-worn and travelled stones were found to occur at a height of at least 4,300 feet on an isolated mountain near the watershed between the Liard and Pelly Rivers. In the Lewes and Pelly valleys, traces of the movement of heavy glacier-ice in northward or north-westward directions were observed in a number of places, the grooving and furrowing being equally well marked at the water-level and across the summits of hills several hundred feet higher. The facts are such as to lead to the belief that a more or less completely confluent glacier-mass moved in a general north-westerly direction from the mountainous district south of the southern sources of the Yukon, toward the less elevated country which borders the lower river within the limits of Alaska. This observation, taken in connection with the evidence of the former northward movement of glacier-ice in the Arctic regions to the east of the Mackenzie (*Annual Report of the Geological Survey*, 1886, p. 56 R), appears to have very important bearings on theories of general glaciation.

The discovery of small rounded bowlders or pebbles of jade (nephrite) on the upper part of the Lewes River may be mentioned as of interest. Though not actually observed in place, the material is evidently derived from the altered volcanic rocks, probably of paleozoic age, which are abundant in the district. The theory that the jade used by the coast tribes for the manufacture of implements was imported by them from Asia, if still held by any, can scarcely any longer be maintained as tenable.

A second minor point of interest brought to light in connection with the expedition is the existence of a very wide-spread deposit of volcanic ash in the Upper Yukon basin. This generally occurs beneath the soil, but is distinctly newer than the silts or latest glacial deposits. It forms a layer which is seldom more than a few inches in thickness, and is doubtless to be attributed to some single great volcanic eruption of a date long antecedent to our historical knowledge of the north-west part of the continent.

George M. Dawson.

SCIENTIFIC NEWS IN WASHINGTON.

National Academy of Sciences; Partial List of Papers; Presentation of Medals. — How to detect Cottonseed-Oil in Lard. — Aboriginal Copper-Workers in the Lake Superior Region; Proofs that they were Modern. — The Siana Indians; Investigations by the Bureau of Ethnology. — International Entomology.

National Academy of Sciences.

The National Academy of Sciences has been holding its annual meeting in Washington during the past week, but too late to report its proceedings in this number. Among the features of the meeting were the presentation, on Wednesday evening, of the Henry Draper medal to Prof. Edward C. Pickering, director of the Harvard Observatory, for his work upon astronomical photography; the J. Lawrence Smith medal to Prof. H. A. Newton of Yale University, for his work on meteors; and the reading of memorial papers commemorative of Prof. J. C. Watson and Capt. James B. Eads, by Prof. G. C. Comstock of Wisconsin University, and Mr. William Sellers of Philadelphia, respectively.

Among the papers expected were the following: 'The Rotation of the Sun,' by Prof. J. E. Oliver of Cornell University, Ithaca, N.Y.; 'The Foundations of Chemistry,' by Dr. T. Sterry Hunt of Montreal, Canada; 'On an Improved Form of Quadrant Electrometer, with Remarks upon its Use,' by Prof. T. C. Mendenhall, director of the Rose Institute, Terre Haute, Ind.; 'On the Vertebrate Fauna of the Puerco Series,' by Prof. E. D. Cope of Philadelphia; 'Re-enforcement and Inhibition,' by Dr. Henry P. Bowditch of Harvard University; 'On Apparent Elasticity produced in an Apparatus by the Pressure of the Atmosphere, and the Bearing of the Phenomena upon the Hypothesis of Potential Energy,' by A. Graham Bell of Washington; 'The Orbits of Aerolites,' by Prof. H. A. Newton of Yale University.

Detection of Adulteration of Lards.

The recent examinations of lards made at the Agricultural Department have resulted in the discovery of a test by which the presence of cottonseed-oil may be detected instantly by any dealer or housekeeper. The experiment is as follows: As much lard as can be taken up on the point of a case-knife is placed in a teacup. About a quarter of an ounce of sulphuric acid is poured upon it and thoroughly mixed with it. If the lard is pure, it will coagulate, and there will be a little difficulty in the mixing. If it is adulterated with cottonseed-oil and stearine, the mixture will take place immediately and easily. After half a minute, one-fourth of an ounce more of sulphuric acid should be poured upon and mixed with it. The whole process thus far should not occupy more than one minute.

The substance thus obtained is poured into a common test-tube, such as may be bought at any chemist's shop for a few pennies. The acid, somewhat colored, will sink to the bottom, and the fatty substance will remain on top. If the lard thus tested was pure, the color of the latter will be that of a light-colored sponge, changing in a minute or so to a dark-cinnamon color. If it has been adulterated with cottonseed-oil, the color at first will be darker, changing immediately to a dark brown. These differences of color are so marked that no experience is required to detect them.

Cards might be printed upon which the colors produced by the sulphuric-acid re-action for both pure and adulterated lards might be shown; and dealers, by using this test, may prove to their customers in a minute or two that the lard that they are selling is an unadulterated article. The experiment is simple, and the cost of it almost nothing. The novel thing about it is the placing of the mixture in a test-tube in which the acid may become separated from the fatty substance, thus making the test much more decisive and satisfactory. This was first suggested by Dr. Thomas Taylor, who has extended his experiments to a great number of different animal and vegetable oils.

Algonkin Metalsmiths.

Mr. Henry Lee Reynolds read a paper before the Anthropological Society at a late meeting, in which he replied to M. Paul du Chatelier, who has discussed the great antiquity of the ancient mines discovered at Lake Superior, in 'Materiaux pour L'Histoire Primitive et Naturelle de l'Homme.' The idea, he said, that these mines were very ancient, is commonly prevalent. Although Drs. Charles T. Jackson and I. C. Lapham gave quite plausible reasons for thinking them to be the works of the present race of Indians, men like Wilson and Whittlesey subsequently published standard works in which they asserted their belief in a contrary opinion; and these latter theories are now being promulgated by a host of writers like M. du Chatelier.

Mr. Reynolds reviewed the evidence upon which these theories are based, criticised some of it as misleading and some of it as having lost its original importance and prominence in the light of later ethnologic and archæologic research, and expressed the opinion that the mines in question are the work of the ancestors of some of the historic Algonkin tribes, if not of the historic tribes themselves. In proof of this he quoted some pertinent testimony from early chroniclers to show that the copper reported as having been found among the historic tribes could not all have been drift-metal discovered upon the surface. Three sources whence the aboriginal copper was obtained were mentioned, a general description of the pre-Columbian status of the art of copper-working given, and an account added of his own method of examining old records and studying archæologic discoveries in his endeavor to learn what this actually was.

The chief end of this paper, however, he said, was to present some facts which seemed to indicate active aboriginal mining operations subsequent to the arrival of the French in the Lake Superior region. After referring to some evidence which mound specimens offered on this point, he added, "But the best assurance of the later fabrication of our copper specimens is to be found in the fact that a vast quantity are discovered upon the surface, particularly in the States bordering upon Lake Superior, while an extremely small percentage come from the numerous mounds existing in the same territory. I examined, last summer, 231 specimens of copper in the possession of the Public Museum at Milwaukee, and 200 more in the cases of the Wisconsin Historical Society at Madison. Not one was found in a mound, but all were either picked up from the surface or turned up with the sod in cultivation of the fields. Now, these specimens, more or less exposed as they are to the action of the atmosphere, bear scarcely any indications of greater decomposition than the specimens found deep in the mounds. How can this be if they antedate the advent of the whites? They are mostly, if not all, implements; and all have been shaped out of native copper by patient handling, doubtless with the assistance, in some cases, of stone moulds. Some are of such shape as to give rise to the suspicion that the workman must have attempted an imitation of some tool or weapon which he had seen in the hands of the French pioneers. The resemblance of the knives and chisels to European ones is very marked, while several of the spear-heads are indeed close copies of the old-fashioned French pike which must have been carried in those days in establishing the Jesuit missions. In proof of this, I saw last summer, in Illinois, one of these old iron pike-heads which had been taken from a mound near by. It had the same three-sided or bevelled feature, formed by a slight ridge running through the centre of one side, which is so often seen in our spear-heads of native copper. Many of these spear-heads also have sockets, and a perforation for a rivet. Now, it is hard to realize how these two ideas of a socket and a hole for a rivet, if they are not imitations, can predominate, as they do, over the simpler form of a tang or notch and the customary Indian method of fastening; for the Indian's first impulse in handling copper would be to imitate the types of spear-heads that he had already fashioned in stone. Then, too, the imitation of these types in stone would have been the simplest forms in the fabrication of copper; and the simplest must, in the natural order of things, be the first that occurs to the uninfluenced native mind. That this suspicion is well founded is demonstrated by the discovery of one of these socket spear-heads in which a broken rivet remained. This rivet proved to be iron. The specimen was ploughed up in a Wisconsin field, and is described by Dr. J. D. Butler in the *American Antiquarian*, vol. iv. p. 232.

"Indian wares, we know, by successive barter or by appropriation by right of war, traversed a vast and extensive territory; yet it must be noted that there is no continental distribution of this class of copper implements such as is observable in other objects of American art. They seemed confined almost strictly to the territory reached by French influence, for in this limited area they outnumber by a surprising majority the aggregate of all specimens of a similar class, mound or surface, found elsewhere in the country."

A series of facts were then presented and commented upon, which give rise to the suspicion that the mines themselves postdate the arrival of the whites. Continuing, he said, "Valuable testimony bearing upon the probability of these observations is furnished by Dr. P. R. Hoy of Racine, Wis. This gentleman found in a grave in his State two crude pieces of mined copper, together with two blue-glass beads of European make. These two lumps of copper had sharp angles and ridges, showing conclusively that they had been mined; for, if they had been drift-copper, they would have been more or less worn and rounded. But this is not all. Among other things associated with those two little European beads was a copper lance-head similar in type and fabrication to one gathered from the *débris* of the Keweenaw mines.

"In the light of such facts as these, the question naturally arises, 'Were not the best part of the copper implements that have been found in Wisconsin, Michigan, and Illinois fabricated since the advent of the French?' It does not seem to have occurred to the writers who describe such specimens, that in those remote, unsettled parts of the country the Chippewas and Winnebagoes could have possessed and worked native copper for many years without the fact being generally known." Mr. Reynolds showed that this was the case, even as late as the second decade of the present century, by giving an extract from a letter of Satterlee Clark, who was the Indian agent for the Winnebagoes from 1828 to 1830.

The Siana Indians.

During last season, 1887, Professor Powell, director of the Bureau of Ethnology, directed that certain researches be made among the Siana Indians of New Mexico. This tribe is located on a mesa (tableland) overlooking the Rio Jemez, a stream draining the Jemez Mountains, and is one of the tributaries of the Rio Grande, forming a junction with that stream about eighty miles south of Santa Fé. There are three tribes of communal dwellers located on this stream, the Jemez, Sianas, and the Santa Anas, the latter two peoples speaking the same dialect. No general results have been of greater interest than those from Siana. This tribe now only numbers about one hundred and twenty-five individuals, though the ruins of their former habitations, which are immediately connected with those of the present, indicate an extensive population.

The habits and customs of these people are in principle much like those of other Pueblos, yet their ceremonials are peculiar to themselves. Their dances are all religious, one of which is the celebrated snake-dance, which occurs every alternate year. This peculiar dance occurs with only one other Pueblo tribe, the Mokis, in Arizona. The Sianas, however, perform this dance in a secluded spot some distance from their present village, which is so accessible to travellers that they are much disturbed at this time. Their other ceremonies are numerous, and are performed in supplication for prosperous crops, for rain, and for protection from disease and other misfortunes. The houses of their village are composed of large, round lava bowlders laid in mortar, on the same general plan of construction as those of other Pueblos. They are extremely idolatrous in their worship. Their estufas are stored with innumerable objects of such worship. In one may be seen a large altar composed of various animals representing the rattlesnake, bear, wolf, panther, wild-cat, and a few nude representations of mythic human beings, which to them are their gods of music, rain, war, etc. In different directions, and not very far distant from their village, are shrines for different gods, representing different great elements, to which these Indians continually pray.

The bureau secured large and representative collections of all the religious and domestic objects possessed by the tribe, also complete notes of their myths, religious rites, and ceremonials, which are to be elaborated for one of the forthcoming reports of the Bureau of Ethnology.

Some Recent Entomological Matters of International Concern.

This was the subject of a paper read before the Philosophical Society at its meeting, March 31, by Dr. C. V. Riley. Selecting three species of insects which prevail in several different parts of the world, and are injurious to agriculture or horticulture, he devoted his paper chiefly to a consideration of their natural history.

The first was the white or fluted scale, — the *Icerya*. This has of late years done great injury to the orange-grove, and to many other trees and shrubs of southern California. Its original home was probably Australia, whence it was introduced into New Zealand, Cape Town, South Africa, and California. All the evidence points to its introduction into that State by the late George Gordon of Menlo Park, about the year 1868, probably from Australia, on *Acacia latifolia*. The trees most injured by it are the acacia, lime, lemon, orange, quince, pomegranate, and walnut.

The second species of which Dr. Riley spoke was the Hessian-fly. An added interest has recently been given to it because of its introduction into England. It has long been known upon the continent of Europe, and the prevailing belief has been that it was introduced therefrom into the United States during the revolutionary war by

Hessian troops. It was first announced in England two years ago by Miss E. A. Ormerod, consulting entomologist of the Royal Agricultural Society, and it has proved more or less injurious. It has rapidly extended during the past two years, so that now it is found on most portions of the eastern coast, extending up into Scotland. In North America it has spread over the entire wheat-producing country, having appeared in California during the past three years. Dr. Riley thinks that all the evidence points to the importation of the Hessian-fly into England from the continent of Europe, and not from America. He is also of the opinion that on account of the cooler summers and milder winters, and the lateness at which wheat is sown in England, there is very little danger that the crops will be injured there to any such extent as in America and in portions of continental Europe. In fact, it is very injurious only under conditions where two generations are pretty likely produced in the same year; and he is satisfied that in England, as a rule, only one generation will be produced.

The third of the insect pests of which Dr. Riley spoke was the hop-plant louse, *Phorodon humuli*, of which the full life-history has been learned within the past year. It hibernates at the present season of the year. The little glossy, black, ovoid eggs of the species are found attached to the terminal twig, and especially in the more or less protected crevices around the bud, of different varieties and species of plums, both wild and cultivated. From this winter egg there hatches a stem-mother, which is characterized by being somewhat stouter, with shorter legs and honey-tubes, than in the individuals of any other generation. Three parthenogenetic generations are produced upon plums, the third becoming winged. This instinctively flies to the hop-plant, which is entirely free from attacks during the development of the three generations upon plums. A number of parthenogenetic generations are produced upon the hop, until in autumn, and particularly during the month of September, winged females are again produced. This is the pupifera or return migrant, and she instinctively returns to the plum. Here she at once settles, and in the course of a few days, according as weather permits, produces some three or more young. These are destined never to become winged, and are true sexual females. Somewhat later, on the hop, the true winged male, and the only male of the whole series, is developed; and these males also congregate upon the plum, on the leaves of which, towards the end of the season, they may be found pairing with the wingless females which stock the twigs with the winter egg. Twelve generations may be produced during the year, but there is great irregularity in the development of these generations, and the return migrant from the hop is produced at the end of the season, whether from individuals of the fourth or fifth generation, or of the twelfth. Each parthenogenetic female is capable of producing one hundred young (the stem-mother probably being more prolific), at the rate of one to six, or an average of three per day, under favorable conditions. Each generation begins to breed about the eighth day after birth, so that the issue from a single individual runs up easily, in the course of the summer, to trillions. The progeny from a single stem-mother may, under favoring circumstances, blight hundreds of acres in the course of two or three months.

The exact knowledge thus gained, said Dr. Riley, simplifies the protection of the hop-plant from *Phorodon* attack. He suggested destroying the insect on the cultivated plum in early spring, and the extermination of the wild-plum trees in the woods. The introduction of the pest into new hop countries in the egg state upon plum cuttings or scions may be avoided. Infection from one hop-yard to another never takes place.

ELECTRICAL SCIENCE.

Electrical Energy from Carbon without Heat.

A FEW years ago Mr. Willard E. Case brought forward a battery in which an electric current was generated without the consumption of the elements of the cell, the energy being derived from some external source of heat. The electrodes were tin and platinum immersed in a solution of chromic chloride, which, at ordinary temperatures, has no action on the plates. If the cell be heated, "part of one of its elements, chlorine, leaves the chromic chloride, goes over and temporarily combines with the tin, forming a proto-chloride of tin." This action generates an electric current with an electro-motive force of about .3 of a volt. When the cell is allowed to cool, the tin crystallizes out again, and the cell is as it was before. We have, then, a current of electricity the energy of which is obtained from the source of heat applied to the cell, the possible efficiency of the arrangement being fifteen or sixteen per cent. For many reasons this cell cannot be practically used; but Mr. Case has pursued the general subject, and, in a paper lately read before the Institute of Electrical Engineers, he has brought forward some extremely interesting and suggestive experiments. It is probable that the ultimate sources from which electrical energy will be derived are natural sources of power, — waterfalls, etc., and coal; the conversion in the latter case being direct. For the former a perfected storage-battery is necessary; for the latter, some means of oxidizing the coal without the production of heat, the energy being converted directly into electric currents. Mr. Case's experiments in the latter field are as follows: "In a glass cell containing sulphuric acid C.P. (specific gravity 1.81, temperature 75° F.) two electrodes were immersed, — one of platinum, the other of lump graphite. Only a slight electro-motive force was indicated, .007 of a volt, due to the combination, the graphite acting as the positive element. On the addition of a small quantity of chlorate of potassium to the acid, the electro-motive force immediately rose to .8 of a volt, the graphite being disintegrated after a time. This cell polarized rapidly, which was partially prevented by mechanical means. . . . A method of exclusion was adopted to ascertain the oxidant of this electrolyte: chlorine peroxide ($Cl\,O_2$) appeared to be the only active agent. It is decomposed by the carbon, chlorine being evolved with some oxygen. It was assumed that in this cell graphitic acid ($C_{11}H_4O_5$) was formed as the result of the chemical actions." Different forms of carbon were tried in the cell, giving a different electro-motive force for each form, varying from .3 of a volt to 1.25 volts.

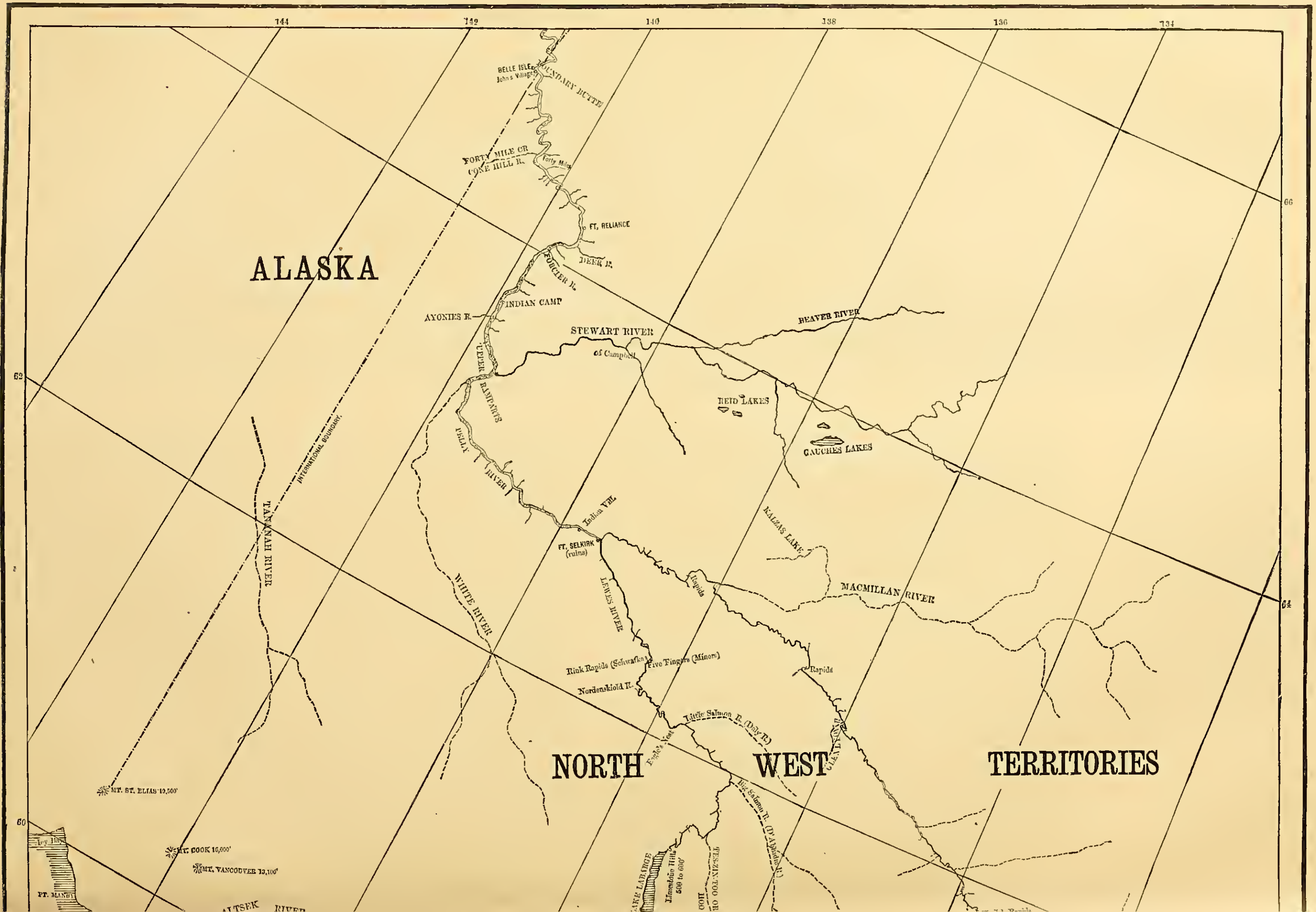
Mr. Case sums up the results as follows: "Undoubtedly the direction of experiments in the future will be to find some cheap substance which will absorb oxygen from the air and give it up to the carbon; in fact, acting as a carrier of oxygen, so oxidizing it without heat. And this is not improbable, as we already know of substances which do this, though giving a low electro-motive force: thus, for instance, the ferric salts are reduced to ferrous by agitating their solutions with carbon, being regenerated by absorbing oxygen from the air. By pursuing this line of investigation, we can be sure we are not ignorantly striving against any law of nature when attempting to convert the whole potential energy of carbon into electrical energy."

If we take the energies of combination of different substances as indicating approximately the electro-motive force obtainable from the action, we will find, in looking at the tables giving energies corresponding to various chemical actions, that the greatest electro-motive force we can hope for with batteries in which metals are consumed does not exceed three or four volts. With the hydrocarbons it is different: the energy in some cases is very great; and a battery in which part of the action consists of the formation of some hydrocarbon, or the change from one hydrocarbon to another, might give a much greater electro-motive force than any battery with which we are acquainted. It is very probable that some one will discover a practicable battery of the type Mr. Case has pointed out.

MAXIMUM EFFICIENCY OF INCANDESCENT LAMPS. — Two things are very well known about incandescent electric lamps: their efficiency increases as we increase the current through them, and their brilliancy, and their life decreases from the same causes. There are two items of cost in electric lighting, — the cost of the current supplied to the lamp, and the cost of renewal of the lamps themselves. By running lamps at a very high candle-power, we decrease the amount of current required per candle, but our bill for breakage of lamps is correspondingly increased. Now, it is evident that if we know the cost of the current and lamps, and the life of lamps corresponding to different efficiencies, we can calculate the least expensive way to run our lamps. This Mr. Howell has done in an excellent paper read before the American Institute of Electrical Engineers. He has obtained, in the first place, the efficiency of certain Edison lamps corresponding to different candle-powers

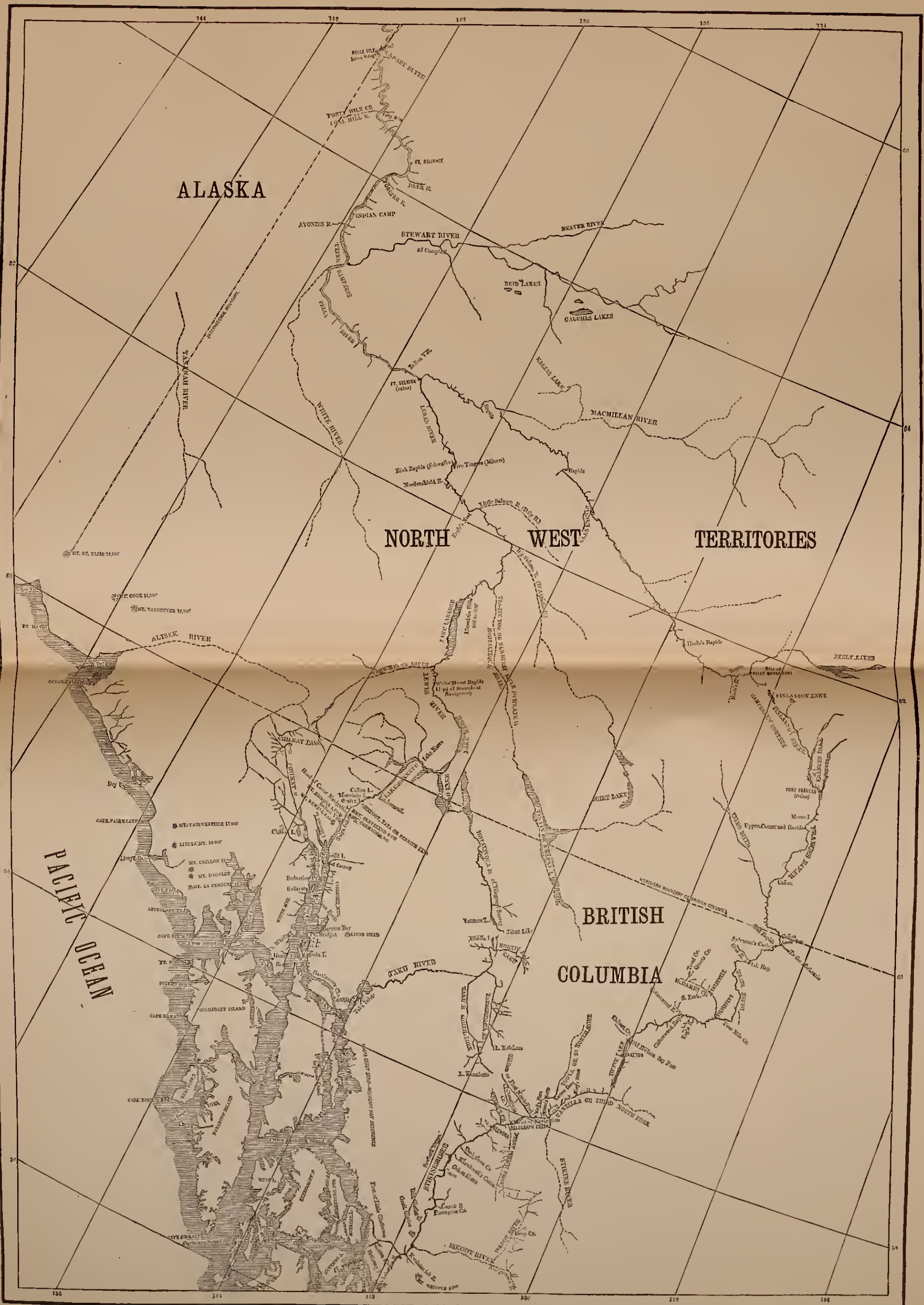
Map of the Upper Yukon River.

(SCALE 1 : 3,000,000.)


ALASKA
NORTH WEST TERRITORIES
INTERNATIONAL BOUNDARY
TANANAH RIVER
WHITE RIVER
PELLY RIVER
UPPER RAMPARTS
STEWART RIVER
BEAVER RIVER
LEWES RIVER
MACMILLAN RIVER
KALZAS LAKE
GAUCHES LAKES
REID LAKES
FT. SELKIRK (ruins)
Indian Vil.
FT. RELIANCE
DEER R.
FORCIER R.
INDIAN CAMP
AYONIES R.
FORTY MILE CR.
CONE HILL R.
Forty Mile
BELLE ISLE
John's Village
BOUNDARY BUTTE
Rink Rapids (Schwatka)
Five Fingers (Miners)
Nordenskiold R.
Little Salmon R. (Daly R.)
Big Salmon R. (D'Abbadie R.)
Rapids
GLENLYON R.
Eagle's Nest
LAKE LABARGE
Limestone Hills 500 to 600'
TES-ZIX-TOO OR HOO
MT. ST. ELIAS 19,500'
MT. COOK 16,000'
MT. VANCOUVER 13,100'
PT. MANBY
Icy Bay
ALTSEK RIVER
144
142
140
138
136
134
60
62
64
66

272.

(SCALE 1: 3,000,000.)



Map of the Upper Yukon River.

SCIENCE, *April* 20, 1888. *No.* 272.

(SCALE 1 : 3,000,000.)

at which they are burned. From another long series of experiments he finds the life of the lamps corresponding to the different efficiencies. With these results, and assuming different prices of current and lamps, Mr. Howell plots curves representing the total cost of operating one hundred sixteen-candle power lamps for one thousand hours; the points of the curves being obtained by varying the efficiency at which the lamps are run, and calculating the total cost from the data he has obtained and assumed. These curves give a definite minimum corresponding to some definite efficiency, the latter varying with the price of current and lamps. These curves are important, as they enable us at once, knowing how much the current costs, to select lamps that will give the best results. On comparing the cost of lamps with the total cost, Mr. Howell finds that in every case the total cost is a minimum when the cost of lamps is about fifteen per cent of the total cost, — a curious and important result.

ELECTRIC LIGHTING AND INSURANCE. — A reduction in insurance rates, where electric lights are exclusively used, has just been voted by the New England Insurance Exchange. The reduction is, however, only allowed where the rules of the exchange are followed in installing the plant, and where the company whose apparatus is used shall pay "any sum assessed as its proportion to defray the cost of inspection." This move has several things to recommend it: it gives to electric lighting the advantage which its superior safety warrants, and it insures the careful installing and regular inspection of the plant. It is in this last that the benefit is greatest. The few fires for which electric lighting is responsible have been the result of cheap and careless work, and with efficient inspection this is impossible. With the wires and appliances that can be purchased to-day, electric lights can be put in buildings in a way to make accident impossible, and electricians can thank their own ill-advised 'economy' for the ill repute in which some people hold the system.

THE DE BERNADO ACCUMULATOR. — It is possible that in the final perfected type of accumulator, different patterns will be used for different purposes. At present the 'grid' type of battery-plate used for lighting-purposes is much thicker and heavier than that used for traction-work. It has long been acknowledged, that, where a very heavy current is to be taken from a cell, the Planté form of plate is preferable to the former, in which the active material is pasted into perforations in cast-lead plates; and there seems a tendency, especially in France, to return to some modification of Planté's original idea. De Bernado requires in his welding process a heavy current of electricity; and to obtain it he has devised a new form of accumulator, which will stand the discharge rate required without any very rapid deterioration. The cell does not differ greatly from the Kabath accumulator, which attracted attention some years ago, but which is now little used. The plate consists of a frame of lead, with lead strips passing from one side to the other of the framework. The alternate strips are corrugated obliquely to give circulation, and all of them are burned at their ends to the frame. The plates so made are 'formed' by the Planté process; that is, by reversing the direction of the current passing between two sets of plates immersed in sulphuric acid, at intervals, until an 'active' coating of sufficient depth is produced. There is nothing especially new about this battery, — it differs but little from the Kabath accumulator, — but it is of interest as indicating the gradual return to the original Planté form, or some modification of it, that is gradually taking place, especially where rough usage is necessary.

HEALTH MATTERS.

Lung-Expansion and Consumption.

DR. THOMAS J. MAYS of Philadelphia, in a paper read before the Philadelphia County Medical Society, still further elaborates the theory which he has repeatedly expressed, and to which *Science* has before referred. This theory is, that an insufficient expansion of the lungs, especially of their apices, has more to do with the development of consumption than the breathing of impure air, and that, for the prevention of the disease, complete expansion of these organs is more important than the breathing of pure air. The title of his paper is 'Apex-Expansion *versus* Pure Air in Pulmonary Consumption.'

Although Dr. Mays acknowledges that wholesome air is of value in the prevention and treatment of consumption, still he is convinced that the purity of the atmosphere plays but a small part in the result. He cites the almost complete exemption from pulmonary consumption of the inhabitants of Iceland, Greenland, and Lapland, whose habitations are notoriously wanting in ventilation, as proof that this disease is not the result of breathing a vitiated and impure atmosphere. On the other hand, people living in tropical regions, who are out of doors most of the time, are by no means free from consumption. Miners and laborers in coal-mines, although continually respiring an atmosphere loaded with impurities, and damp and musty, suffer but very little from this disease.

That which has been an important factor in establishing the belief that pure air is such an essential element in limiting the ravages of consumption, is that those who occupy elevated or mountainous regions are less liable to this disease than those who live near the sea-level. In reference to this fact, Dr. Mays says that it is estimated that at an elevation of six thousand feet the surface of the body is relieved of nearly seven thousand pounds' pressure. When such an enormous weight is lifted from the body, it is quite evident that its interior must also be markedly affected: the pulse is accelerated from fifteen to twenty beats per minute; the respiration is quickened from ten to fifteen breaths per minute; and evaporation from the skin and lungs is increased. These are some of the immediate effects. Protracted residence in such a high region enlarges the chest capacity. The Quichua Indians, who dwell on the elevated tablelands of Peru, have enormous-sized chests, containing capacious lungs with large air-cells. The Mexican Indians possess chests which are out of proportion to the sizes of the individuals. Dr. Denison says that children born in the Rocky Mountains have chests of unusually large capacity, and M. Jaccoud states that at St. Moritz the respirations are not only more frequent, but fuller.

The reason why the number of respirations increases while ascending a high elevation becomes clear when we take into consideration the fact that at the sea-level a cubic foot of dry air contains about 130 grains of oxygen, while at an elevation of six thousand feet it contains only about 106 grains, — nearly twenty-five per cent less than the body is accustomed to breathe at or near the seaboard.

Professor Mosso has recently proven experimentally that man possesses a lung capacity which is nearly one-fourth larger than the actual necessities of life at the sea-level demand; hence by employing his whole lung capacity he can extract a sufficient amount of oxygen from this attenuated atmosphere without difficulty. And herein lies the secret why so many consumptives, and others with weak lungs, derive such a great benefit when they resort to a mountain climate. Every available space in the chest is brought into requisition to furnish the needed amount of oxygen, the apices are called out of their lethargic state, and the alveoli are inflated; and, if the infiltrated areas are not dispersed, the surrounding alveoli are kept permeable, and so the disease is at least limited, and called into abeyance.

In concluding his paper, Dr. Mays says, "Now, after reviewing the whole subject, we are driven to the conclusion that the line of immunity from consumption, which in the early history of our country was located at the Atlantic seaboard, and which has gradually receded westward with the tide of civilization, until at present it has reached the latitude of Colorado, will not stop in its course until it touches the shores of the Pacific; that the question of curing the disease does not depend on the purity or freshness of the air, or upon the number of bacilli which the atmosphere may contain, or upon the amount of oxygen which may be introduced into the body, for these are all secondary considerations; but it is simply a mechanical question, — a question as to the best mode of expanding the lungs, and especially the apices of our round-shouldered and flat-chested patients, of removing the infiltrated products already existing, and of enhancing the constitutional resistance."

LEPROSY IN AMERICA. — The recent cases of leprosy in Philadelphia have been the means of awakening a new interest in that loathsome disease. Dr. Charles W. Allen, in the *New York Medical Journal*, gives a most complete account of the disease, and the views of the best authorities regarding its communicability.

His conclusions are as follows: 1. Leprosy has existed to a considerable extent in this country during the past twenty years; 2. The tendency is for the disease to increase, not only from immigration, but also from the occurrence of sporadic cases: 3. It is a contagious disease, and may be transmitted from parent to offspring; 4. Transmission probably takes place, in some instances at least, through inoculation; 5. Segregation has been proved to be the only sure means of freeing a country from its ravages; 6. It is the duty of the government to establish central leper-hospitals or isolated settlements for the treatment of those afflicted, and for the protection of the community at large.

BURNING GARBAGE. — Sanitarians in this country have for many years been considering the practicability of destroying the garbage of a city by fire. The city of Milwaukee has been a pioneer in the movement to demonstrate the feasibility of this method of disposal. The commissioner of health of that city, in a recent letter to the *Sanitary News*, gives some interesting facts concerning the experience of that city. "For more than five months our garbage has been consumed to a dry, inodorous ash. A test of the cost of consuming the garbage was made on Dec. 27, with the following result: the amount received and consumed was 40,215 pounds, and the fuel required was 5,000 pounds, being 4.3 cents per hundred pounds of garbage consumed, — a result highly gratifying when we consider that on that date there was a large quantity of snow and ice mixed with the garbage."

BOOK-REVIEWS.

Volcanoes and Earthquakes. By SAMUEL KNEELAND. Boston, Lothrop. 8°.

THE present volume is mostly a description of ascents of volcanoes and of remarkable eruptions which the author has witnessed, or the description of which he has taken from reliable sources. Thus the book has some value as a book of travel, or for making clear the phenomena of volcanic action to the general reader. The author has visited so many volcanic regions, — the Hawaiian Islands, Iceland, the Mediterranean Sea, Japan, and the islands of south-eastern Asia, — that he is well able to give a description of the peculiarities of the various volcanoes; and the principal value of the book lies in the vividness of the descriptions, which is due to the personal knowledge of the author of so great a part of the earth's surface. He wisely abstains from a long discussion of the theory of volcanic phenomena, as this would be out of place in a popular book like this, but merely enumerates the various theories that are now held by geologists. The latter part of the book contains descriptions of remarkable earthquakes.

Lectures on the Physiology of Plants. By JULIUS VON SACHS. Tr. by H. Marshall Ward. Oxford, Clarendon Pr. 8°. (New York, Macmillan, $8.)

VON SACHS'S text-book of botany has always been regarded as one of the best in any language, and no better proof of this can be given than the fact that four editions have been published and exhausted. Dr. Sachs was requested by the publishers of his text-book, and also by his botanical friends, to prepare a fifth edition. This he declined to do, and gives his reasons therefor in the following language: "It is an old experience, that, while one works up with pleasure a second and even third edition of a comprehensive work, frequent repetition eventually becomes inconvenient or even painful to the author. Having experienced this sufficiently with the fourth edition, I was unable to make up my mind to a fifth. Apart from other circumstances, I was driven to this, to an important extent, by the progressive development of my scientific convictions." He adds, that his mode of comprehending important questions of the physiology of plants had undergone changes in various directions, and that for several years the wish had been taking a more and more definite form, in his mind, to set forth the most important results of the physiology of plants in such a manner that not only students, but also wider circles, should be interested in them. Believing that this object could be better attained by a freer form of exposition than that of a text-book, he determined to present the subject in the form of lectures. This determination has resulted in the 'Vorlesungen über Pflanzen-physiologie,' which Professor Ward has translated in a most admirable manner.

The volume consists of forty-six lectures, arranged in six parts. These latter are, 1. Organography; 2. The external conditions of vegetable life, and the properties of plants; 3. Nutrition; 4. Growth; 5. Irritability; 6. Reproduction. It is impossible to give more than this brief outline of a book which embraces so many and such varied topics as are treated in the eight hundred and two pages of text. Professor Sachs has succeeded in his undertaking, to a degree which is exceptional, to produce in this series of lectures a treatise adapted to the wants of the skilled botanist and the educated man, whose studies have been in other directions, but whose desire for a knowledge of the physiology of plants has hitherto been unsatisfied. The subject is made much more intelligible by the four hundred and fifty-five woodcuts with which the book is embellished; while the elaborate index, covering thirty-three pages, makes it exceedingly valuable for reference.

Photography applied to Surveying. By HENRY A. REED, U.S.A. New York, Wiley. 4°. $2.50.

THE author gives a concise sketch of the successful experiments made in photographic surveying, and sets forth the methods now in use. The book is principally founded on the publications of Frenchmen who have paid particular attention to developing this branch of the art of surveying. The author's discussions of the various methods are clear and concise. The principle of photographic surveying is the same as that of ordinary surveying. Stations are occupied by the photographer; and the angles, which are generally measured by the theodolite, are measured on the photographic negative. For this purpose the camera is provided with a level, and the distance between the sensitive plate and the object-glass is kept constant. The horizon is marked on the negative, and a measurement of distances serves for finding the azimuths and elevations of objects. In making the photographs, various instruments are used, — the ordinary camera, with a wide-angle objective; a camera in which a cylindrical sheet of sensitive paper takes the place of the plate, and in which the photograph is produced by turning the camera around its axis; or the photographic plane table. In the latter the photographic view is represented on a horizontal surface, the rays from the object being reflected either by a triangular glass prism or by a spherical convex reflector. The author justly claims great advantages for these methods, among which the most valuable are the cheapness of field-work, and the great amount of information contained in the photographic views. Setting aside geodetic operations, photographic surveying is undoubtedly the cheapest and best method wherever the principal object is to attain, not the greatest possible accuracy, but the fullest amount of information in the shortest possible time. Therefore the publication is very valuable and welcome, giving a concise review of the advantages and results of this method, which is still very little used in this country. We may be allowed to add a few remarks on this subject, in addition to Lieutenant Reed's full discussion. Photographic surveying cannot attain the same accuracy as ordinary surveying; but the errors are so small, that for tertiary, and even for secondary triangulation, it meets all demands. Its greatest value, however, lies in the full material it furnishes for constructing the orographic features of a country. No topographer, however experienced he may be, can draw contour lines as well from sketches and a few fixed points as he can construct them from photographic surveys. The number of elevations that may be determined by this method is practically without limit. Another important use of photographic work is the facility it affords for resurveying tracts of land, particularly in regard to changes in culture. Deforestation, roads, the extent of agricultural land, etc., are shown on the photographs, and may readily be inserted in maps without fear of omissions. Thus it will be of the greatest utility for the questions of a census. Lieutenant Reed touches only slightly upon its use in reconnaissance work. For this purpose the cylindric arrangement gives the greatest satisfaction, principally as it dispenses with the use of bulky and heavy photographic plates, which are difficult to carry. For topographic work of this kind, the use of photography, supplemented by sketches made by the *camera lucida*, gives by far the best results. A concluding chapter of the book deals with telescopic and balloon photography. We do not believe that the latter will be of great service to the surveyor, except in cases of war for the military engineer, and it may be useful for showing the culture of extensive tracts of land without commanding points in resurveying.

Beginner's Anatomy, Physiology, and Hygiene. By JOHN C. CUTTER. Philadelphia, Lippincott. 16°. 30 cents.

FROM the title of this book, and from the preface, we gather that it is intended for young pupils, for beginners, and we are therefore gratified to find that the writer proposes to employ such language as is simple and direct, and that technical and long words are, as far as possible, avoided. Throughout the text this rule has been fairly well adhered to, though when our eyes fell upon the frontispiece, we began to fear that the author had forgotten to carry out the plan which he had promised. This frontispiece represents the muscular system of the human body, and the scientific names of these muscles are given as they would be in the most advanced work on anatomy. Orbicularis palpebrarum, occipito-frontalis, sterno-cleido-mastoid, extensor carpi-radialis, and others too numerous to mention, stand out prominently in the illustration. This same criticism applies to other figures in the book, although perhaps to a less degree.

While it may be well to describe the effects of alcohol and tobacco in such a work as this (and of course, to meet the demand for which this and so many other books of this kind have been recently written, this must be done), we question whether it is wise to speak of the effects of chloral. The writer says of it, that, "when used for some time, it may cause heart-trouble. It lessens the heart's power. It makes its action irregular. It sometimes, in a small dose, causes death by suddenly stopping the heart's action." In another portion of the book he says that in proper doses it induces rest and sleep. This kind of talk should, in our judgment, be omitted from a book written especially for beginners. The phraseology of some parts of the book is open to unfavorable criticism. In speaking of deformities of bones of children and youth, the author says that corsets and snug-fitting shoes ought not to be worn by the young, the inference from which statement would seem to be that these articles may be worn by the adult; and yet in another place he says, "Do not wear close-fitting chest and waist garments. Corsets and tight vests compress the lower ribs. They press the digestive organs out of place. They hinder deep and proper breathing."

Another inconsistency we observe in the following statements: "Cheese is a rich and hearty food, suitable for hard workers." "A food which disagrees with a person ought to be avoided. As a rule, pastry, cheese, fresh white bread, and 'made dishes,' most often cause discomfort." Dr. Cutter is opposed to candies for children. He says that common pure candies contain not only cane-sugar, but materials which are difficult to digest. Candies "should be denied children." We think the doctor goes a little too far in thus absolutely prohibiting the use of candies. There is no doubt that they are abused, and that it would be far better not to use them at all than to continue their excessive use; but at proper times, and in proper quantities, we do not think that good candies are so pernicious as he would have us believe.

The author incorporates in his book what he calls "simple directions for the management of a few common emergent cases," which, from the references already made, we infer are intended as a guide to the young pupil, the beginner. Under the heading 'Management of a Poison Case,' he says, "If it is an irritant poison (like verdigris, corrosive sublimate, etc.), give rapidly-beaten-up eggs. If it is an opium compound, give strong coffee, and keep the patient awake. If it is a vegetable narcotic (henbane, belladonna), keep him quiet. Always summon the ablest doctor to manage the case." It would, we imagine, be a sufficiently difficult task, especially for a young pupil, to determine whether the poison taken was an irritant, an opium compound, or a vegetable narcotic; but to decide who is the 'ablest' doctor, *hic labor, hoc opus est*.

While there is much in this book to criticise, there are also many things to commend. The general arrangement is good, and the figures are fairly illustrative of the text. There is one feature which is especially noteworthy, and should be reproduced by writers of other text-books of this kind. We refer to the instructions to teachers for the demonstration to classes of the principles of physiology; as, for instance, the demonstration of the movements of the blood in a frog under the microscope, and the changes which take place in the size of the human chest during inspiration and expiration; and the impoverishment of the air during respiration. This method has been admirably worked out by Professor Martin of Johns Hopkins University, in his text-books; and we are glad to see that Dr. Cutter has embodied the same plan in his book.

Taken as a whole, 'The Beginner's Anatomy, Physiology, and Hygiene,' is neither better nor worse than many other books of the same class, scores of which have lately issued from the press in response to the demand for physiologies which should teach the effects of alcohol and narcotics.

A Treatise on Algebra. By CHARLES SMITH, M.A. New York, Macmillan. 8°. $1.90.

THIS work is the latest put forth by the English press, which is just now very prolific in algebras.

The present work is intended for students who already have some knowledge of elementary algebra. For this reason the opening chapters, while complete, are nevertheless brief.

These chapters differ but little from those of the text-books in common use. Stress is laid, however, on the idea that algebra is simply the science of numbers; and the commutative, associative, distributive, and index laws are well illustrated.

Some theorems are introduced much earlier than usual. Thus, detached co-efficients are introduced in the chapter on multiplication, and the theorems on the divisibility of rational integral expressions in the chapter on factoring. In this last chapter, also, the quadratic expression ax^2+bx+c is resolved into its linear factors; and this method of resolving into factors is adopted for the solution of all quadratic equations.

Chapter IX. treats of equations with one unknown, — simple, quadratic, binomial, and reciprocal, — and contains so much, that it is decidedly confused, and the weakest chapter of the book. Here, also, the author fails to explain the terms 'infinite' and 'infinity' in a satisfactory manner.

Chapter XII. is on symbolic algebra, and contains seventy excellent examples.

Imaginaries are treated by modern methods. In the definition of 'arithmetical progression,' the customary *lapsus calami* is made. Choice should be illustrated with more examples. Series are fully and clearly treated. The binomial theorem is proved by a modification of Euler's proof, based on the introduction of Vandermonde's theorem. Euler's own proof is also given. Logarithms are considered without any thing being said about the proof of the index law for incommensurable exponents, the almost universal omission.

The definition of 'probability' is the usual faulty one given by Todhunter and others. This chapter is not clear, and is too short.

The chapter on determinants is based on the well-known works of Muir and Dostor, and is by far the best short treatment of determinants with which we are acquainted in any language. This chapter contains all the essential parts of the subject, and we recommend it to every one who desires a brief but comprehensive knowledge of these famous expressions.

On the whole, the book much resembles that of Mr. Todhunter. In form Mr. Smith has improved on the latter's work; but in fundamental ideas, — ideas which go down to the root of mathematical reasoning, — and in definitions, Mr. Smith's work is but little, if any, superior to Mr. Todhunter's. The book is simply an excellent text-book of high grade, its most distinctive feature being the chapter on determinants.

Eighteenth Annual Report of the Massachusetts Bureau of Statistics of Labor. Boston, State. 8°.

CARROLL D. WRIGHT'S Massachusetts report for 1887 deals very exhaustively with a single subject, — the unemployed. The figures taken are those of the State census of 1885, and show a wide distribution of the unemployed as a whole, because the industries of the State were in a more or less depressed condition. The investigation comprehended "all remunerative occupations, of whatever description, and included all persons of any age who were earning their living: that is to say, all persons engaged in the government service, whether national, state, city, town, or county; all professional people; all persons engaged in domestic and personal service, with the exception of housewives and those who assisted in the housework at home only, and for which they received no stated compensation; all persons engaged in the various branches of trade, in transportation, agriculture, the fisheries, manufactures, and mining; day-laborers; apprentices, and those who for various reasons were unemployed for the entire year; the unemployment being properly classified as regards each occupation in presenting results." The chief purpose of the inquiry was to ascertain, so far as possible, first the depression, if any, in particular trades or industries; and, second, the extent of unemployment generally, without regard to the particular kind of work performed during the twelve months preceding the taking of the census.

The main results, as shown in Mr. Wright's summary, are as follows: the whole number of persons, of both sexes, who were unemployed at their principal occupation during some part of the year represented by the twelve months which preceded the census enumeration of population, May 1, 1885, was 241,589. Of this number, 178,628 were males, and 62,961 were females. As compared with the total population of the State, this shows that for every 8.04 persons there was one person unemployed for some part of the year at his principal occupation; and as regards sex, that there was for every 5.22 males one male unemployed, and for every 16.03 females one female unemployed, at principal occupation during some portion of the time covered by the investigation. By 'unemployed' is meant, of course, unemployed at their principal occupation *during some part* of the twelve months preceding May 1, 1885. As a matter of fact, only 822 persons, less than one-third of one per cent, were unemployed during the entire twelve months. Of the unemployed, 73.94 per cent were males, and 26.06 per cent females. Of the 822 unemployed during the entire year preceding May 1, 1885, 91.61 per cent were males, and 8.39 per cent females. More than 50 per cent of unemployed were from twenty to thirty-nine years of age. Perhaps the pith of the report is given on p. 266, where it is said, "A little less than one-third of the persons returned as being engaged in remunerative labor were unemployed for about one-third of their working time; while, on the other hand, the working population of the State, considered in its entirety, were employed at their principal occupation for a little less than eleven months during the census year." The results of the investigation would seem to indicate, Mr. Wright points out, that all the products of manufactures could have been secured by steady work for 307 working-days, of 9.04 hours each, if this steady work could have been distributed equally among all the persons engaged in manufactures; while all the remunerative work of the State, of whatever kind, if it could have been distributed equally among the entire working population, could have been accomplished in 307 working-days, averaging 8.99 hours per day.

The report is extremely valuable, and one more evidence that Colonel Wright is the right man, in the right place.

Manual for Instruction in Domestic Science. New York, Industrial Education Association, 1888.

THE prefatory note of this little volume states that it is a manual "drawn up for the use of the students of the College for the Training of Teachers, and for such teachers as adopt the method of instruction followed at the college by Miss Julia H. Oakley, professor of domestic economy there. It is not intended to be complete or exhaustive. Its aim is to give the outline of a carefully developed course of instruction in cooking, which shall have an educational rather than a technical value, and to furnish notes for the conduct of the same." All persons who are watching the manual-training movement will admit at once that this manual, and others like it for sewing, industrial art, and wood-working, are absolutely necessary, if crude and empirical methods are to be kept out of the schools. They are as essential as good text-books in arithmetic and grammar. This manual is simple and clear, and will be of great assistance to teachers. For each lesson an outline is given, and the principles it illustrates carefully developed, before the recipe for its practical illustration is stated. This prevents mere imitation, and makes the practical work of the domestic science course rational and educational. The manual will doubtless be widely used, and its influence will be wholly for good.

Mechanics of Materials. By IRVING P. CHURCH. New York, Wiley. 8°. $3.

THE modern tendency in writing text-books upon the relation of forces, and their resistances as manifested upon and in the materials employed in engineering, appears to be toward a clearer stratification of the various departments of that branch of science.

Dynamics and statics have long been clearly defined, but there are many books at this moment before the eyes of students, in which the science of statics and the properties of materials are too promiscuously treated to leave a clear impression except upon the initiated. The result is, that the average student has but a vague idea of what he has been studying, and of its relation to other branches of science.

Professor Church's plan of treatment is a threefold division into dynamics, statics, and, to quote his own words, "mechanics of materials: a treatise on the elasticity and strength of beams, columns, arches, etc., for students of engineering." The latter title is that of his latest work, now under discussion. It is a book of 320 pages, and might properly be called a treatise upon molecular mechanics, being a discussion of the laws of resistance to externally applied forces of the molecular fibres of materials when used in various forms.

The treatment of the subject is independent of the kind of material — steel, iron, wood, etc. — so far as the development of the formula is concerned, as they are based upon certain mechanical assumptions, that are independent of the nature of the material.

That phase of the subject which will perhaps never submit to pure mathematical analysis — the properties of materials, the behavior of various kinds of materials under stress, the laws of fatigue, proper working-stresses, etc. — is very properly passed over with an occasional allusion, and such tables of values as may be necessary to solve the problems dispersed through the book.

In this connection it may be said that a table in which the average ultimate tensile strength of soft steel is given at 80,000 pounds, and of wrought iron at 60,000 pounds, without further explanation, is calculated to give the student an erroneous impression of the latest practice, in which even 55,000-pound steel has been recommended for bridge-work, and 80,000-pound steel is considered a high grade to use.

Again: an allusion to Wöhler's law of fatigue of materials as a recent discovery seems a misleading expression to apply to investigations made twenty years or more ago. But it is far easier to criticise minor points than it is to improve on the main features of Professor Church's work, an investigation of which discloses the following plan: —

The first chapter discusses the theory of stress and strain; and by mathematical investigation, of the action upon an assumed form of elements of the mass, the nature and relation of direct tension or compression, and shear, to each other, are clearly defined. The modulus of elasticity is explained; and, in short, all the fundamental principles of stress and strain in the abstract are shown in their true relations.

Chapters II.–V. inclusive, occupying about one-third of the book, relate to torsion and to flexure of beams.

The generally employed theories of Navier have been used instead of a more intricate mathematical analysis, and a specially clear statement is made of the assumption upon which the formulæ for beams are based. Column formulæ are treated in the twenty-three pages comprising Chapter VI. The usual presentation of Euler's, Hodgkinson's, and Gordon's theoretical formulæ occurs, and some allusion is made to modifications in practice.

Consistency, perhaps, prevented Professor Church from giving what students much need, — a clear statement of what our engineers are actually doing in practice with the designing of columns, and the fact that certain simple formulæ derived from experiment seem to agree with actual tests fully as well as, if not better than, those mentioned.

Chapters VII.–XI. inclusive, taking about one-third of the space, treat of arches mainly by the use of the moment polygon. The insertion of the analytical chapter on linear arches is chiefly a concession to the mathematical students.

The final chapter is devoted to the graphics of the continuous girder, as an appropriate conclusion to the graphics of the arched rib of which the former is a special case.

The topics are frequently illustrated, calculus in its simplest form is employed, the equations are carefully described, and special attention is given to a proper defining of the values and character of the various data used.

A general view of the book as a whole leads to the opinion that the line of treatment has been clearly thought out by the author, and each topic logically developed in its proper place. In that respect it is worthy of all praise, but the impression is at the same time created, that, as a text-book for technical schools, it is too elaborate. For those who make a special study of its branch of engineering, it is admirable: for the average student, who has many other topics to share the attention and time of his course, much pruning would be necessary, to the detriment of his understanding of the subject as a whole.

Chips from a Teacher's Workshop. By L. R. KLEMM. Boston, Lee & Shepard. 16°.

MR. KLEMM has put together the most practical little book on education that has recently come from the press. It is scrappy, to be sure, but it is comprehensive. If the style is jerky, and at times harsh, it is also concise. The contents of the book are not wholly new. Many, if not most, of the chapters have appeared as articles in educational journals. But the author is quite right in believing them worth reproducing in book form. Too frequently the teachers of the country are written *at*: Mr. Klemm does not write *at*, but *to* them. He is most successful when handling and illustrating the details of schoolroom-work. His more elaborate essays are not so good. His chapter of 'Open Letters to a Young Teacher' will appeal to thousands, and ought to appeal to tens of thousands, of readers. They all ask the very questions, at some time or other, that Mr. Klemm answers. They would turn in vain to the encyclopædia, or the formal book on pedagogy, or the psychology text-book, for any hint as to how to overcome chronic tardiness or uncleanliness in pupils. Mr. Klemm's experience furnishes some excellent suggestions as to how to proceed. We have never seen more ingenious and effective devices for arousing interest and making instruction comprehensible than his board for teaching numeration, his use of paper-folding in teaching fractions, and his original illustrations, from the boundary-lines of the several States of the Union, of the proper way to connect the teaching of history and geography.

We must bear in mind that the teaching force is largely distributed in rural districts. It is far from lectures and libraries, and remote from the centres of civilization. It wants to know how it may improve practically. It wants both knowledge and skill. It needs devices, not essays. It wants to be guided, not preached at. Mr. Klemm knows these facts, and has written this book accordingly. It is especially adapted to the needs of the country teacher.

NOTES AND NEWS.

THE agricultural experiment station of the University of Tennessee, Knoxville, has been re-organized, with the following officers: director, Charles W. Dabney, jun.; assistant director, in charge of field and feeding experiments, Charles S. Plumb; botanist and horticulturist, F. Lamson Scribner; chemist, Winthrop E. Stone; entomologist, Henry E. Summers; assistant in field and feeding experiments, Charles L. Newman.

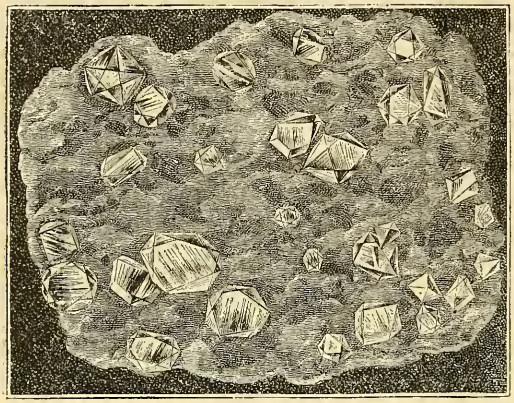
— On Monday evening, April 16, 1888, after the adjournment of the regular business of the New York Academy of Sciences, the members interested in mineralogy held a meeting for the purpose of establishing a section on mineralogy. This section will meet when enough interesting material presents itself before the New York Mineralogical Club to insure a full evening of business, and will publish all papers presented before the Mineralogical Club in the Proceedings of the Academy. Mr. George F. Kunz was elected president, and Mr. J. H. Caswell secretary, of the section.

— Several years ago the Danish Government sent out a number of expeditions into the interior of Greenland. These were followed by Nordenskiöld's and Peary's expeditions. In the coming summer Dr. Frithjof Nansen of Bergen will make an attempt to cross the desolate ice-covered highland of Greenland, starting from the east coast. He intends to start from the neighborhood of Cape Dan with three companions, and will attempt to reach the Danish colonies on the west coast. It is doubtful whether he will succeed in reaching the coast in time, as a wide belt of pack-ice prevents ships approaching it. From former experiences, it would seem that Cape Dan, where the coast makes a sharp bend, is the place where approach is easiest; but the whalers who will convey Dr. Nansen to Greenland do not penetrate the heavy masses of ice lying close to the coast of Greenland. The ice generally opens late in the season, and it is to be feared that travelling on the inland ice will be very difficult at that season. Nordenskiöld's and Peary's experiences show that early in spring, before the commencement of the thaw, is the best time for such an enterprise: therefore it would seem that success is most probable for a traveller who would winter in Greenland.

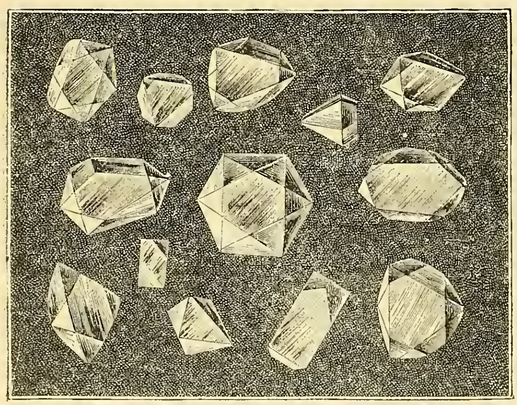
— Of late years the Portuguese have made attempts to increase their influence in the countries adjoining the colony of Benguela. For this purpose Major de Carvalho was sent into the empire of Lunda, from which journey he returned in October, 1887, after an absence of three years. A number of stations were established east of the Kuango, and, in consequence of prolonged stays at such stations, the new capital of the Muata Yamvo was reached in December, 1886, after two years of travel. The expedition was unable to proceed farther eastward, but it appears from the available reports that it succeeded in establishing Portuguese influence in the empire of the Muata Yamvo more securely. The expedition was probably undertaken on account of the encroachment of the Kongo Free State and the Germans upon that part of southern Africa which the Portuguese considered their property for a long while. The English are also endeavoring to establish their dominion in southern Africa as firmly as possible. A treaty has recently been made with the chief of Amatonga Land; and thus the whole coast of South Africa, from Orange River to Delagoa Bay, has become English.

— The English are incessant in their endeavors to open a trade-route from India to China. One of the preliminary steps to reach this object is the establishment of a railroad from the valley of the Brahmaputra to the upper part of the Irawadi, by which means they expect to strengthen their position in Burmah. The region to be traversed is extremely mountainous, and the road will have to cross the Patkoï Mountains. Recently an expedition has been sent out to ascertain the feasibility of building the road, of which Messrs. Michell and Needham were in charge. They found that the Patkoï Range, which was formerly considered an insurmountable barrier for the trade between Assam and Burmah, can be crossed on a number of passes not exceeding 2,500 feet in height. They succeeded in crossing it on one of these passes with five elephants, and state that a road can be built without great difficulties. Thus the recent reports of Colqhoun and Woodthorpe are confirmed. At the present time the trade between China and Burmah is carried on by caravans consisting of from 200 to 2,000 animals, which cross the range during the dry season, i.e., between the months of November and May. They cross the territory of the Kachins, who exact heavy payments from them; nevertheless the caravans are subject to frequent attacks, and must be protected by an escort of armed men.

— In 1877 Fremy succeeded in obtaining very small crystals of artificial rubies. In 1887 he resumed his experiments, and, with the assistance of Mr. Verneuil, has succeeded in obtaining beautiful and comparatively large crystals. *La Nature* describes his experiments according to the report given to the Academy of Sciences of Paris, illustrated by cuts, which we reproduce here. On Feb. 27, Fremy and Verneuil presented to the academy these crystals, which were obtained by the action of fluorides upon aluminium. Fluoride of barium was made to act upon aluminium containing traces of bichromate of potassium. The regularity of crystallization, which was obtained after numerous experiments, was found to depend principally upon the fire, which regulates and varies the chemical action. The crystals obtained in 1877 were laminated and friable. They were very thin, and embedded in a vitreous mass, which rendered it almost impossible to isolate them. Besides this, their chemical composition varied to a certain extent. By the new process they are easily separated from the porous matrix in which they are formed. The matrix is thrown into water, which is violently agitated. While the light matrix is broken and remains suspended, the rubies settle down on the bottom of the glass. They



are very clean, and it was found unnecessary to apply any acids for further cleansing. They are rhombohedral and exactly like natural rubies. Numerous analyses showed that they did not retain a trace of baryte, and that they were formed by pure aluminium colored by traces of chrome. The crystals are regular and of adamantine lustre. They are of perfect transparency, as hard as natural rubies, and cut topaz. Like the natural rubies, they turn black on being heated, but resume their color after getting cold



again. Having thus produced by synthesis rhombohedral crystals of rubies with all the physical and chemical properties of the most beautiful natural rubies, and forming them in a matrix which may be compared to that enclosing the natural mineral, Fremy and Verneuil believe they have definitely settled the question of the origin of rubies. So far, the experiments have been made with 50 grams of material only, and the crystals have therefore been comparatively small, not exceeding 0.02 of an inch in diameter. The authors, however, propose to continue their experiments on a larger scale, and expect to be able to make rubies of large dimensions.

LETTERS TO THE EDITOR.

**** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

Twenty copies of the number containing his communication will be furnished free to any correspondent on request.

The editor will be glad to publish any queries consonant with the character of the journal.

Is the Rainfall increasing on the Plains?

IN connection with the recent discussion of the question of increasing rainfall west of the Mississippi River, I wish to call attention to some serious errors in the rainfall record at Fort Leavenworth, — a record fifty years in length, and therefore frequently quoted in support of the popular view. While examining these observations, I recently found that the precipitation for January, 1871, was given as 11.25 inches, — a most extraordinary amount. Suspecting such a result, I examined the files of the *Leavenworth Times*, and found that the precipitation for that month, as measured by Mr. F. Hawn, was 0.14 of an inch of rain, and 9.25 inches of *unmelted* snow. Unquestionably the Fort Leavenworth record is also mainly composed of unmelted snow. Further examination showed that the amounts recorded for the other winter months of 1871 and 1872 contained a similar error, and that consequently the total for 1872 should be 41.6 instead of 51.6, and for 1871 should probably not be greater that 35.5 instead of 56.75.

These latter values for the totals of those years are given in the 'Smithsonian Tables' and in the 'Reports of the Kansas Board of Agriculture,' and, so far as I know, have never been corrected by any one that has used these observations in discussing the question of a climatic change in rainfall.

If such errors as these exist in the records, it is not surprising to find that the rainfall of Kansas is increasing.

GEORGE E. CURTIS.

Topeka, Kan., April 10.

Scarlet-Fever.

I WOULD call attention to the fact that in many of the scarlet-fever reports published in your columns an assumption has crept in which seriously injures the value of the conclusions thus based.

All disease has a *first* case in any locality: *this* is the case only of real use to investigate scientifically. Other subsequent cases may or may not be due to the same cause as the first, or to contagion. To assume that a case, however closely following a first case, is due to contagion or infection from it, not allowing ample margin for other as yet unknown causes, is simply stupid, as it weakens arguments in a good cause and for the public good.

I had this winter a boy with his second genuine attack of scarlet-fever within six months. No cause of either attack was found. His brother and sisters did not suffer from contact with him, although it was attempted, of course, to isolate the patient. I myself caught the disease at about this time, but I am by no means willing to admit a belief that such disease came to me from contact with this or other patient. Many cases are known to me where exposure wholly failed to cause this disease, even in weak, poorly nourished individuals.

If any time is more dangerous than another in regard to liability to cause spreading of the disease, it would not be, according to my experience, that of the much talked and written of period of desquamation.

JOHN DIXWELL, M.D.

Boston, Mass., April 16.

Queries.

31. BLONDE AND BRUNETTE. — What is a blonde, and what is a brunette, and what is she who is neither of these? Definitions of the words I can find in a dictionary: they do not cover the ground. A woman with black or dark brown hair and eyes and a dark complexion is a brunette. But here is one with those eyes and hair and a very light complexion: she is not a pure brunette; what is she? A girl with light hair and eyes and a dark complexion is not a blonde; what is the name for her? What is she whose hair is almost black, complexion dark, but light-gray eyes? (By 'complexion' is meant the color of the skin of the face.)

BOOK-NOTES.

— D. C. Heath & Co. announce for June a translation of Paolo Mantegazza's 'Testa, a Book for Boys.' It is a companion book to DeAmicis's 'Cuore.' The translation will be made under the supervision of Prof. L. D. Ventura of Boston, and of the Sauveur Summer School of Languages.

— Among the contents of the *Cosmopolitan* for April is an interesting article by John Burroughs on 'Science and the Poets.'

— The April number of the *Quarterly Journal of Economics* will contain the reply of Pres. F. A. Walker to Professor Macvane's criticisms on his 'Theory of Business Profits;' an article on the Philadelphia ground rent system, which has done so much to make that city a 'city of homes,' by Messrs. Allison and Penrose of the Philadelphia bar; and a study of United States tariff history from 1830 to 1860, by Professor Taussig. A variety of minor articles and the usual valuable bibliography fill out the number.

— Prof. Charles E. Munroe, chemist of the United States Torpedo Corps, will explain in popular language, in the May *Scribner*, the chemical constitution and action of modern explosives as applied to the purposes of war and peace.

— David A. Wells's discussion of the 'Economic Outlook,' in *The Popular Science Monthly*, will be closed in the May number of that magazine.

— The *Andover Review* for April maintains the high standard which has been reached. Dr. Hyslop, of the Johns Hopkins University, accepting the theory of evolution, points out its limitations as applied to ethics. Rev. Dr. Denison of Williamstown, under the title 'Mental Narcotics and Stimulants,' gives a criticism of the 'mind-cure.'

— The April volumes of Ticknor's Paper Series will be as follows: 'The Led-Horse Claim,' by Mary Hallock Foote, ready April 7; and 'Len Gansett,' by Opie P. Read, editor of *The Arkansaw Traveler*, ready April 21.

Proceedings of Societies.

Philosophical Society, Washington.

April 14. — C. O. Boutelle, Geodetic Azimuths; Simon Newcomb, On the Fundamental Concepts of Physics.

Torrey Botanical Club, New York.

April 10. — E. E. Sterns, On a Peculiarity in the Fruit of Smilax; M. S. Bebb, Some White Mountain Willows.

Boston Society of Natural History.

April 18. — Alpheus Hyatt, Life of the Late Prof. Spencer F. Baird; Charles S. Minot, New Apparatus for cutting Microscopical Sections Automatically.

Natural History Society, Agricultural College, Mich.

April 13. — E. R. Lake, Distinguishing Features of Starch-Grains in Different Varieties of Potato; Professor Durand, Notes on an Aquarium; W. J. Beal, Structure of Wood; L. H. Dewey, Poison Ivy,

Publications received at Editor's Office, April 9–14

ATKINSON, W. P. The Study of Politics. Boston, Roberts. 63 p. 16°. 50 cents.
BISHOP, G. R. Exact Phonography: a System with Connectible Stroke Vowel Signs. New York, The Author. 244 p. 12°. $2.
BLACK, G V. A Study of the Histological Characters of the Periosteum and Peridental Membrane. Chicago, W. T. Keener. 138 p. 8°.
GEIKIE, A. An Elementary Geography of the British Isles. London and New York, Macmillan. 127 p 24°. 30 cents.
OLDBERG, O., and LONG, J. H. A Laboratory Manual of Chemistry. Chicago, W. T. Keener. 435 p. 8°. $3.50.
ROBINSON. E. G. Principles and Practice of Morality; or, Ethical Principles discussed and applied. Boston, Silver, Rogers, & Co. 252 p. 12°. $1.50.
TANNER, T. H. Memoranda on Poisons. 6th ed. Rev. by Henry Leffmann, M.D. Philadelphia, Blakiston. 177 p. 24°. 75 cents.
WILDE, Lady. Ancient Legends, Mystic Charms and Superstitions of Ireland. Boston, Ticknor. 347 p. 12°. $2.50.

SCIENCE

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SCIENCE

FRIDAY, APRIL 27, 1888.

THE NATIONAL ACADEMY OF SCIENCES, which held its annual meeting in Washington last week, is the most learned of all American scientific societies. Incorporated by the government of the United States, its expenses are paid out of the national treasury, although its members serve without compensation. Made by law the official scientific adviser of the government, it is required, at government expense, to enter upon any scientific investigation which may be asked for by the head of either of the departments, and its conclusions are accepted as those of a competent and disinterested tribunal. For instance: the consolidation of the various Western surveys that were being prosecuted at government expense into the present admirably organized National Geological Survey was the result of a report by a distinguished committee of the National Academy of Sciences, to whom the subject had been officially referred. Another important report was one on the work and discoveries of Dr. Peter Collier, formerly chemist of the Agricultural Department, in relation to sorghum; and more recently a special committee has been engaged, at the request of the secretary of the treasury, in an investigation in regard to the value of the polariscope test in determining grades of sugar. In addition to this official work, the National Academy of Sciences holds two meetings a year, at which business connected with its organization and work is transacted, new members chosen, and papers announcing new discoveries in science, or describing lines of original investigation, are read by members or by other persons presented by members. The meeting this year has been an important one. A larger number of papers than usual were presented; and, although no remarkable discoveries were announced, there was evidence of great activity, in many of them, along all the lines of original scientific investigation. The law limits the number of new members to be elected at each annual meeting to five. Only three were chosen this year, — Profs. G. Brown Goode, Albert Michelson, and S. C. Chandler; but the great scientific attainments of each are an ample guaranty of the purpose of the National Academy to maintain the high standard that has placed it at the head of all our scientific associations, and made membership in it so much coveted by scientific men.

NOTHING IN CONNECTION with the annual meeting of the National Academy of Sciences in Washington last week was likely to impress an attendant at its public sessions more than the ardent enthusiasm of its members in the work in which they are engaged. A few of them are young men, and more of those not members introduced to read papers had not yet reached middle age; but even they were no more absorbed in their labors, or more proud of their successes, than the wearers of snowy locks and gray beards. Even the venerable Dr. C. H. F. Peters, the distinguished astronomer, seemed as much elated at his success in proving that Tycho Brahe, in 1572, with a rude quadrant constructed by himself, determined the position of Nova with an accuracy that would be creditable to a modern astronomer with his wonderfully exact instruments, as was the youngest investigator at being able to add something to the sum of scientific knowledge.

IN THE LAMENTED death of Dr. Cornelius R. Agnew, whose funeral services took place on Saturday last, New York City lost one of its foremost citizens, and science and education a powerful advocate and friend. It was remarked on Saturday last, that so representative an assemblage of men had never before gathered at the bier of any one man in this city, and it was because of the many-sided character of Dr. Agnew's activity. Himself a physician and specialist of the very first rank, he chose the broader field of education for his most powerful efforts. As a trustee of the College of Physicians and Surgeons, as a trustee of Columbia College, and as a founder of the School of Mines, his influence in the cause of higher education can only be appreciated by those who felt it, and by those who worked with him. The friends of Columbia College looked instinctively to him to control and guide that university development which is now beginning its course. From all of these boards and from many others his wise and kindly counsel will be sorely missed, and his place cannot be easily filled, if ever. Dr. Agnew's personal contributions to medical science were principally made in the departments of ophthalmic and aural surgery. He was a prominent member of the Sanitary Commission during the Rebellion, and afterwards one of the founders of the Union League Club.

MEETING OF THE NATIONAL ACADEMY OF SCIENCES.

A Successful Meeting; New Members and Councillors; Medals and Obituary Memoirs; Receptions and Dinners; List of Papers. — Is There Such a Thing as Potential Energy? — Serpent-Mound. — A New Method for the Biological Examination of the Air. — An Interesting Parasite on the Beaver. — The Orbits of Aerolites. — Improvements in Spectrum Photography; Carbon in the Sun. — Vertebrate Fauna of the Puerco Series.

THE meeting of the National Academy of Sciences, held at Washington last week, was in every respect a successful one. About forty members attended; the number of papers offered was greater than usual, nearly all of which were read *in extenso*, leaving very few to be read by title; and the attendance at the public meetings was good. While very little of the business transacted by the academy and by the council is disclosed to the public, it is known that the annual reports were satisfactory, although there was nothing in them of an unusual character. No great scientific discoveries were announced, but several of the papers read showed important progress in special lines of original investigation. Without disparity to others, three may be mentioned as of special importance. They were, 'The Orbits of Aerolites,' by Prof. H. A. Newton; 'Preliminary Notice of the Object, Methods, and Results of a Systematic Study of the Action of Definitely Related Chemical Compounds upon Animals,' by Profs. Wolcott Gibbs and Hobart Amory Hare; and 'Report of Progress in Spectrum Photography,' and 'Note on the Spectrum of Carbon and its Existence in the Sun,' by Prof. H. A. Rowland.

The new members of the academy this year are Prof. G. Brown Goode of Washington, assistant secretary of the Smithsonian Institution, in charge of the National Museum, and a distinguished naturalist; Prof. Albert Michelson, the physicist, of Cleveland, O. He is the gentleman who, when he was in the navy, undertook and carried out at Annapolis novel experiments to determine the velocity of light. He becomes the youngest member of the academy. The third new member is Prof. S. C. Chandler, the distinguished astronomer, of Cambridge, Mass. The six additional members of the council chosen at this meeting were Messrs. Brush, Langley, Meigs, Pickering, Remsen, and Gould.

On Wednesday evening the room at the National Museum in which the meetings of the academy were held was filled by an audience that was gathered to witness the presentation of two gold medals. One, the Lawrence Smith gold medal, was awarded to Prof. H. A. Newton of Yale University, for the study of meteors; and the other, the Henry Draper gold medal, to Prof. E. C. Pickering of Harvard University, for researches in stellar photography. On the same evening obituary memoirs were read, as follows: by Prof. G. F. Barker of the University of Pennsylvania, on the late Prof. Henry Draper of New York; by Prof. Comstock, on Prof. Watson of the University of Michigan; and by Mr. William Sellers of Philadelphia, on Capt. James B. Eads.

The president, Prof. O. C. Marsh, announced the death, since the last meeting, of Dr. F. V. Hayden, an active member of the academy, and Prof. Asa Gray, an associate member.

Largely attended receptions, at which many of the most distinguished people in Washington, both in official, scientific, and literary life, were invited to meet the members of the academy, were given by Prof. Langley and Prof. Alexander Graham Bell, — the former at the Smithsonian Institution, and the latter at Prof. Bell's elegant Washington residence, which was opened for the first time on that occasion since its injury by fire several months ago. A number of dinners were also given during the week in honor of distinguished members of the academy.

The following is a full list of the papers entered: 'The Rotation of the Sun,' by J. E. Oliver; 'The Foundations of Chemistry,' by T. Sterry Hunt; 'On an Improved Form of Quadrant Electrometer, with Remarks upon its Use,' by T. C. Mendenhall; 'On the Vertebrate Fauna of the Puerco Series,' by E. D. Cope; 'Re-enforcement and Inhibition,' by H. P. Bowditch; 'On Apparent Elasticity produced in an Apparatus by the Pressure of the Atmosphere, and the Bearing of the Phenomenon upon the Hypothesis of Potential Energy,' by A. Graham Bell; 'The Orbits of Aerolites,' by H. A. Newton; 'A Large Photographic Telescope,' by E. C. Pickering; 'A New Method for the Biological Examination of Air, with a Description of an Aerobioscope,' by W. T. Sedgwick and G. R. Tucker, presented by J. S. Billings; 'Preliminary Notice of the Object, Methods, and Results of a Systematic Study of the Action of Definitely Related Chemical Compounds upon Animals,' by Wolcott Gibbs and Hobart Amory Hare; 'On the Auditory Bones of the Batrachia,' by E. D. Cope; 'The Orbit of Hyperion,' by Ormond Stone, presented by S. Newcomb; 'Map of Connecticut River Region in Massachusetts,' by B. K. Emerson, presented by J. W. Powell; 'Parallel Series in the Evolution of *Cephalopoda*,' and 'Evolution of *Cephalopoda* in the Fauna of the Lias,' by A. Hyatt; 'The Evidence of the Fossil Plants as to the Age of the Potomac Formation,' by L. F. Ward, presented by J. W. Powell; 'Vision and Energy,' by S. P. Langley; 'Report of Progress in Spectrum Photography,' and 'Note on the Spectrum of Carbon and its Existence in the Sun,' by H. A. Rowland; 'On the Constitution of the so-called Double Halogen Salts,' and 'Studies on the Rate of Decomposition of the Bromides of the Saturated Alcohol Radicals,' by Ira Remsen; 'The Characteristics of the Orders and Suborders of Fishes,' by Theo. Gill; 'The Serpent-Mound and its Surroundings,' by F. W. Putnam; 'The Systematic Relations of *Platypsyllus* as determined by the Larva,' by C. V. Riley, presented by Theo. Gill; 'On the Position of the Nova of 1572, as determined by Tycho Brahe,' by C. H. F. Peters; 'Some Notes on the Laramie Groups,' and 'On the Structure and Relations of Placoderm Fishes,' by J. S. Newberry.

In selecting papers for notice in *Science*, those that admit of statement in popular language have been taken rather than those which in themselves are most important. Some of the latter are so technical in their character as to be intelligible only to specialists. The abstracts of papers are not given in the order in which they were read.

The Hypothesis of Potential Energy.

The full title of Professor Alexander Graham Bell's paper read at the morning session of Thursday was, 'On Apparent Elasticity produced in an Apparatus by the Pressure of the Atmosphere, and the Bearing of the Phenomenon upon the Hypothesis of Potential Energy.' Professor Bell showed to the academy an apparatus that looked like the bellows of an accordion. It consisted of a dozen or more sections, each eight inches long, four inches wide, and two inches deep, connected by an air-tight fabric which surrounded them and covered the outer portions of the end ones. A tube was inserted in the middle one by which the air could be exhausted. Before it was attached to the air-pump, the bellows was not elastic. Bent either to the one side or the other within certain limits, it would remain in the position in which it was placed. But when the air was partially exhausted, if bent to one side or the other, from the position it assumed, it would spring back to its original position with considerable force.

Of course, this elasticity was not due to potential energy, so called, in the bellows, but to the pressure of the atmosphere upon the outside of it, holding the sections of it in close contact. An apparently similar phenomenon in a piece of steel (as in a sword-blade, for instance) is explained by saying that there is potential energy in the steel. Professor Bell's experiment raises the question whether the cause of the elasticity is in the steel itself, or outside of it; whether, in fact, there is any such thing as potential energy in matter, or if its elasticity is not due to its surroundings.

Professor Bell exhibited two very interesting modifications of his apparatus. In the first the sections of the bellows were thinner on one side than on the other; so that, when the air was partially exhausted, it would curl up in the form of a single section of a spiral spring. When in that form, it resisted an effort either to coil it tighter or to straighten it out, although it had none of that apparent elasticity when filled with air under the normal pressure. In the second, a large section was placed in the middle of the bellows, and smaller ones each side of it. When the air was partially exhausted, it was forcibly bent to form an arc of a circle, and a string attached to each end, thus forming of it a bow, from which an arrow was shot.

An interesting discussion ensued after the presentation of Professor Bell's paper. Professor Simon Newcomb thought that Professor Bell's experiments suggested that molecular attraction, commonly called adhesion, may be due to an outward medium, but he did not think it advances them at all on their way to the discovery of this medium. He then defined the terms 'potential energy' and 'conservation of energy,' and explained what scientific men mean when they use them.

Major J. W. Powell objected to the use of the phrase 'potential energy' as unscientific. As ordinarily employed, it is understood to mean something that can do something, while really it is only a name for something that we know nothing about. The thing it applies to is nowhere, it does nothing, we know nothing about it. The term as usually employed is misleading.

Professor Newcomb replied that there is nothing unknown or indefinite about the term 'potential energy,' and repeated his former definition and explanation with several pertinent illustrations. Professor Abbe probably suggested the cause of the divergence of opinion between Professor Newcomb and Major Powell when he said that the confusion arose because physicists give a definite meaning to the term 'potential energy,' which naturalists do not.

Serpent-Mound.

A series of photographic views projected upon a screen made the paper on 'Serpent-Mound and its Surroundings,' by Professor F. W. Putnam of Harvard University, one of the most entertaining to the non-scientific attendants at the meeting of the National Academy. This curious earthwork is in Adams County, O., on a bluff about one hundred feet high, which forms one of the banks of Brush Creek, about eighty miles from its mouth. The land upon which it stands, with that surrounding it, comprising about seventy acres, has been purchased by the Peabody Museum, and set aside as a park. A gravel road has been built from the turnpike to and into the grounds, a spring-house erected, and picnic-grounds laid out. Although Professor Putnam began an examination of the mound during visits to it several years ago, a systematic exploration was not undertaken until last year; and the paper presented to the academy was a report of progress of that exploration.

Briefly described, the mound consists of an oval earthwork about four feet high and twenty feet across, enclosing a space eighty feet long and twenty feet wide. The length of the structure on the outside is one hundred and twenty feet, and its width sixty feet. There is a little mound of stones within the enclosed space. Near one end of this mound begins another of similar construction, but having the form of a serpent. The jaws are extended as though the snake was about to swallow the oval mound; the head and neck are well defined; the body has three turns, and the tail a double coil. The entire length of the serpent is about 1,420 feet.

Near these principal mounds are several minor ones, and to the south of the serpent a space which bears evidence of having been both the site of an Indian village and also a burial-ground. The whole tract was originally covered with timber and bushes, but it was subsequently cleared and cultivated. Professor Putnam has restored the grass, and has planted about the mound specimens of all the trees that grow in that section of Ohio, thus adding another attraction to the place.

Several years ago Professor Putnam picked up a fragment of human bone that had been turned out by the plough, and at the point where he found it he began to dig last summer. Very near the surface he discovered a human skeleton, a few portions of which only were missing. There was no doubt that this skeleton was modern, — that the burial had been made by the historic Indians, perhaps within the present century. A number of large stones which were originally set up upon their edges about the grave — one at the head, one at the foot, and several along the sides — had been thrown down by the plough, but had not been much removed from their original positions.

This grave was on the edge of what seemed to be a mass of stones about eleven feet long and six feet wide; and a trench dug around the edge of this disclosed several other graves, some of them deeper than the first one discovered, and covered with stones.

Want of space forbids a detailed description of the explorations of last summer. It is sufficient to say that Professor Putnam is convinced that most of the graves are those of interlopers; that is, not of the Indians who built the mound, but of a later race, who probably were ignorant of their predecessors, and did not know that they were living on an old burial-ground. But the skeletons of two of the supposed mound-builders were found. A section made through the centre of one of the mounds disclosed the bones of several 'intruders,' one of which had been disturbed by a woodchuck; but at a depth of six feet was found the skeleton of the man over whom the mound was raised as a monument. The bones were those of a large man, about six feet in height, and showed him to be a person of massive frame. The body lay upon its back, with the right arm extended at right angles, and the left arm at the side. The only object found near it was a mussel-shell that lay near the bones of the left leg.

Beneath the skeleton was a layer of clay that had been placed there, and upon which a fire had been kept for a long time. Near the surface the clay had been burned almost as red as a brick, and it showed evidence of heat to a depth of several inches. On the top of the clay were the ashes from the fire, and perhaps others, several inches thick; and upon these the body had been laid, and the mound erected over it.

In another instance, in the burial-place where the first skeleton was found, the body had been laid upon flat stones covered with a layer of ashes, not from a fire built upon the spot, but elsewhere, and which Professor Putnam suspects were produced from burning corn. He has not examined them carefully enough to determine. There is no mound at this point.

The explorations will be continued during the coming summer, and a further report was promised for the next meeting of the academy.

A New Aerobioscope.

A paper on 'A New Method for the Biological Examination of Air, with a Description of an Aerobioscope,' prepared by Professor W. T. Sedgwick of the Massachusetts Institute of Technology, describing experiments and inventions made by himself and one of his students, Mr. G. R. Tucker, was one of the popular features of Wednesday's session. Professor Sedgwick was introduced by Dr. J. S. Billings of the Army Medical Museum, who spoke briefly of the importance and difficulty, in cultivating bacteria from germs obtained from the air, of being certain that nothing was obtained except what is desired, and that what is wanted is secured.

Professor Sedgwick gave a brief history of the discovery of the existence of germs in the air, and of the advancement of scientific knowledge on that subject to the present time. He spoke of the cultivation of germs, and described the different kinds of apparatus in use for obtaining these germs. He then showed how, by a series of steps, he and Mr. Tucker have perfected an instrument for securing the germs, which he calls an 'aerobioscope,' and which is superior to any of those devised by European biologists. Without attempting a full description of this apparatus, it is enough to say that it consists of a glass tube six inches long and two or two and one-half inches in diameter. It is open at one end, and continued at the other at a greatly reduced size, not more than one-eighth of an inch in diameter. The tube is sterilized by heating, and four or five inches of sterilized granulated sugar is placed in the small part of the tube. Professor Sedgwick said that it had been denied that sugar could be sterilized, but he had accomplished it, raising the temperature as high as 120° C. without converting the sugar into caramel. Sterilized nutrient gelatine is then introduced into the tube, and forms a film upon the inner surface. A portion of the air the germs of which it is desired to examine is then drawn slowly through the tube from the larger end. The germs are arrested by the sugar; so that, when the ends of the tube are closed, they may be knocked down with the sugar into the larger part of the tube, and are developed on the gelatine. The sugar also becomes dissolved, and is a nutrient for the germs.

Professor Sedgwick showed why sugar was a better medium for holding back the germs than sand, glass wool, or any of the other substances that have been used. He also described an apparatus he has invented for introducing the germ-laden air into the tubes and at the same time accurately measuring it, and also the method of preserving the sterility of the stoppers. He exhibited a number of tubes prepared for experiment, and others in which germs were growing in various stages of development.

The Systematic Relation of Platypsyllus as determined by the Larva.

Professor C. V. Riley, in his paper on the above subject, drew attention to the unique character of *Platypsyllus castoris*, a parasite of the beaver, and gave an epitome of the literature on the subject, showing how the insect had puzzled systematists, and had been placed by high authority among the *Coleoptera* and the *Mallophaga*, and made the type even of a new order. He showed the value, as at once settling the question of its true position, of a knowledge of the adolescent stages. He had had, since November, 1886, some fourteen specimens of the larva obtained from a beaver near West Point, Neb., and had recently been led to study his material at the instance of Dr. George H. Horn of Philadelphia, who, at the last monthly meeting of the Entomological Society of Washington, announced the discovery of the larva by one of his correspondents the present spring, and who has a description of the larva in type. Professor Riley indicated the undoubted coleopterological characteristics of the insect in the imago state, laying stress on the large scutellum and five-jointed tarsi, which at once remove it from the *Mallophaga*, none of which possess these characters. He also showed that the larva fully corroborates its coleopterological position, while its general structure, and particularly the trophi and anal cerci and pseudopod, confirm its clavicorn affinities. He showed that the atrophied mandibles in the imago really existed as described by LeConte, and that even in the larva they were feeble, and of doubtful service in mastication. He mentioned as confirmatory of these conclusions the finding by one of his agents, Mr. A. Koebele, of *Leptinillus* (the coleopterological nature of which no one has doubted, and the nearest ally to *Platypsyllus*), associated with the latter upon beaver-skins from Alaska; also the parasitism of *Leptinus* upon mice. He paid a high compliment to the judgment and accuracy of the late Dr. LeConte, whose work on the imago deserves the highest praise, and whose conclusions were thus vindicated. "*Platypsyllus*, therefore," he concluded, "is a good coleopteron, and in all the characters in which it so strongly approaches the *Mallophaga* it offers merely an illustration of modification due to food-habit and environment. In this particular it is, however, of very great interest as one of the most striking illustrations we have of variation in similar lines through the influence of purely external or dynamical conditions, and where genetic connection and heredity play no part whatever. It is at the same time interesting because of its synthetic characteristics, being evidently an ancient type, from which we get a good idea of the connection in the past of some of the present well-defined orders of insects."

The Orbits of Aerolites.

Professor H. A. Newton, in discussing the orbits of aerolites, presented the results of the observation and study of a great number of meteors. Without following his line of argument, which was a very able one, his principal conclusion may be given, which is that the aerolites are moving in direct and not in retrograde orbits; that is, they move in the same general direction as the earth, and not in an opposite direction. The fact that the earth does not meet as many as it overtakes is one of his reasons for this conclusion. At the same time he admitted that there may be two reasons why fewer meteors met by the earth should be observed, besides their actual comparative number: first, they may move with such velocity that few reach the earth; and, second, they may fall when men are asleep or not abroad, that is, in the morning hours. The first of these points he did not discuss; but of the second he said, that of ninety-four observed aerolites that reached the earth, and whose zenith is known only at the instant they fall, more appeared in the afternoon than in the forenoon, seven-eighths of them in the daylight. Of the meteorites which we have in our cabinets, he said, and which have been seen to fall, by far the greater part have come from stones that were following the earth, and not moving in the opposite direction.

Spectrum Photography and the Spectrum of Carbon.

Professor H. A. Rowland of Johns Hopkins University presented two brief but very important papers on the spectrum. With new and greatly improved instruments invented and constructed at the university, he has succeeded in making a much more perfect map of the solar spectrum than his former one. The definition of the lines is far better than before, and in some cases single lines have been divided up. He also projected upon a screen, pictures of a number of the groups of lines in the spectrum of carbon, and announced his discovery of the wider distribution of carbon in the sun than has previously been demonstrated.

Vertebrate Fauna of the Puerco Series.

In his paper on the above subject, Professor E. D. Cope gave the position of this formation as below the lowest eocene beds, and above the upper cretaceous, and so of doubtful reference to one or the other of these great systems. The beds of Puerco occur in New Mexico; and Professor Cope said that he had described one hundred and six species from them, of which twelve are reptiles, one a bird, and ninety-three are mammalia. Besides a species of snapping-tortoise (*Chelydra crassa*, Cope), the reptiles presented nothing remarkable excepting three species of aquatic saurians of the genus *Champsosaurus*, Cope, which have their nearest relations in the period next older (Laramie). The greatest interest attaches to the mammalia. The species all belong to extinct families and suborders, except four possible lemurs; and the predominant orders of the first immediately following in time are absent. Eleven of the species are probably monotromes, or of the same order as the Australian duck-bill; forty-nine are flesh-eaters; and twenty-six are hoofed types. All the forms show themselves to be the ancestors of the later and modern mammals by indubitable characters of their structure.

AN ETHNOGRAPHICAL COLLECTION FROM ALASKA.

THE American Museum of Natural History in New York has received a magnificent ethnographical collection from Alaska, collected by Lieutenant Emmon, which forms a valuable supplement to the Powell collection from British Columbia, in the same museum. While the latter includes principally specimens of Haida and Tsimpshian origin, the new accession has been collected among the Tlingit, in whose territory Lieutenant Emmon spent more than five years. The new collection is now on exhibition in the museum, occupying about a fourth of the ethnological hall.

It is arranged in several groups, the first comprising a collection of fishing implements and weapons. The implements resemble in style those of the Haida and other tribes of the North-west coast. Of particular interest is a throwing-stick from Sitka, carved in the style peculiar to the Tlingit and Haida. The implement itself, however, is undoubtedly an imitation of the Eskimo throwing-board. The next group comprises a collection of weapons and armatures. We find among these, jackets made of heavy elk and sea-lion skins, which were impenetrable to the stone and copper weapons of ancient times. The Russian buttons on one of these show that it was used comparatively recently. Besides these, there is a series of remarkable armatures made of round sticks tied firmly together, and of thin pieces of wood arranged in a similar way. While the body was thus protected, heavy masks and hats, carved so as to present the crest of the warrior, fairly covered the head. They consisted of two or three parts made of heavy wood; and we can easily imagine how fierce a Tlingit warrior, incased in this armature, must have looked. The stone battle-axes, of which the collection contains quite a number, could hardly hurt men protected by this hat and coat.

In the same case in which these armatures are on exhibition, we see a collection of whistles used in dances. These do not properly belong to the Tlingit, who do not use whistles at their festivals, but are imported from the Queen Charlotte Islands, the country of the Haida, who have a great variety of these instruments. There is one flageolet in the collection, and several others are known which were collected among the Haida; but it is doubtful whether they are an original invention of these tribes, or an imitation of European instruments. It is very remarkable that the Tlingit should hardly use any whistles during their dances, while all tribes of British Columbia use them to a great extent. This is one of the few facts that are known, tending to prove that the culture of North-west America has been derived from various sources. It is to be regretted that the Powell collection does not contain whistles from the Kwakiutl, which would serve as a valuable object of comparison with those of the Haida, of which the museum possesses a great number.

Lieutenant Emmon has collected very valuable implements made of mountain-goat horn; but, what is more interesting, he shows us how these beautiful spoons and ladles are manufactured. The elegant curvature of the handle is produced by means of a strong piece of wood with two oblique perforations, a larger and a smaller one. The lower portion of the horn is pushed through the wider perforation, and the point turned back so that it can be pushed into the smaller hole. Thus it gets the curved shape required for the handle. The spoon itself is pressed between two pieces of wood, similar to a lemon-squeezer. By the side of the mountain-goat horn implements we observe beautifully carved paint-brushes, paint-pots made of stone, paints, baskets, and other household goods.

The most interesting part of the collection, however, is the large number of masks and dancing-implements, the greater part of which have been taken from graves. There are also very valuable and interesting rattles. It is remarkable that the collection contains only a few rattles in the shape of ravens, and these not elaborately carved, while the Powell collection contains many beautiful specimens of this class. This fact shows that they were probably not originally a Tlingit, but a Haida or Tsimpshian design. Besides this, Lieutenant Emmon states that they are only used in dances and festivals that have no religious character. In all shamanistic ceremonies other styles of rattles are used. Among the Tsimpshian, on the other hand, the raven rattle is the exclusive property of the Raven gens. Among the rattles of the Tlingit we observe many a beautiful carving, and it is worthy of remark that most of them represent certain myths or mythical beings. We observe the fabulous grandmother of men, of whom the Haida also tell, the Yēk (the genii of man), and the shaman tearing out the tongues of various animals in order to obtain the power of witchcraft.

Above these rattles, neck-rings made of red-cedar bark are exhibited. It appears, from a study of the Emmon and Powell collections, that these rings are not by any means so extensively used by the Haida and Tlingit as by the Kwakiutl, among whom they are closely connected with their religious ceremonies and dances. Indeed, it seems almost impossible to properly classify the neck-rings of the Haida and Tlingit, which seem to be used almost exclusively as ornaments. Among the Kwakiutl, the spirits of the dead, the cannibal, and other mythical figures, are each represented by a peculiar kind of ring, which is highly prized by its owner. When these rings are worn, the faces of the dancers are painted in a certain way, peculiar to each mythical figure, which may be suggestive of the origin of the use of masks on the coast. We notice a much decayed ring in Emmon's collection, carefully woven by folding narrow strips of cedar-bark. The Tlingit were unable to give any information as to the use of this ring. It is in use among a certain gens of the Kwakiutl (Qanikila) near the north point of Vancouver Island. The ring is set with haliotis-shells, and adorned with ermine-skins, the ends being rolled up in helix-like figures. A head-ring made in a similar way belongs to the dress of the dancer. It is exclusively worn by the daughter of the chief of the gens Qanikila, and is highly valued. An enormous quantity of bark is required for its manufacture. Its occurrence in a Tlingit grave shows the extent of the trade all along the coast, even before the advent of the whites.

In the same case a great number of crowns used by dancers is exhibited. They are made of mountain-goat horns, of wood carved so as to imitate the shape of the horns, or of copper. They are also used by the neighboring tribes. Among the head-ornaments we observe a great number of strips made of bear-skin with two ears. The same kind of ornament is found in the Powell collection, collected among the Tsimpshian, who trim it with human hair dyed red and white. Of course, there are painted leather aprons, and beautiful blankets woven of mountain-goat wool, in great variety.

The most important part of the collection are the masks, of which a great number are exhibited. They are especially valuable, as Lieutenant Emmon took great pains to ascertain the meaning of the masks, which thus become a rich source of information for the student of ethnology. A comparison of these masks with others collected on Vancouver Island and in Dean Inlet shows that the style of North-west American art, although uniform in general outlines, has its specific character in various localities. The imitation of animal forms is much closer here than in the southern regions, where the forms are more conventional, certain attributes of the animal alone being added to human figures. Another and a very interesting peculiarity of these masks are the figures of animals attached to the faces. The Eskimo tribes of southern Alaska carve their masks in the same fashion, numerous attachments belonging to each. This is another proof of the influence of Indian art upon that of the Eskimo. The figures attached to the faces refer, as a rule, to certain myths; and the same is true of the Eskimo masks and their characteristic wings and figures.

A few of the masks in the Emmon collection, although used by the Tlingit, are evidently of foreign origin. There is, for instance, a mask of the human-headed crane, one of the principal masks of the Tsimpshian; and another one with two faces, the outer being cut in the middle and opening on hinges. Such masks are also peculiar to southern tribes.

A considerable number of masks show deep hollow eyes and sunken cheeks. They represent the heads of dead men. Among the other a certain class with thick lips and beards, and eyebrows made of otter-skin, are of interest. They represent the fabulous Kushtaka, the otter people, of which many tales and traditions are told. Another remarkable mask is that of the mosquito. This is of special interest, as the mosquito is among the southern tribes the genius of the cannibal, and as cannibalistic ceremonies are not known to be practised by the Tlingit. It may therefore be assumed that the myth referring to the mosquito is found in a somewhat altered form among the Tlingit.

A great number of small idols, the Yēk, or genii of the shamans, forms another group of the collection. They are used in incantations. There is also a very remarkable pillow, — a curved piece of wood, nicely carved, which is placed under the shaman's neck while he lies in a trance, and helps him to confer with the spirits.

We will only mention the numerous charms, bone and stone ornaments, beautiful jades, slate, and other stone implements, many of which are beautifully finished. This remarkable collection is one of the most complete, systematic, and consequently valuable, brought from the North-west coast to the museums of our country. It is to be hoped, that, after the new wing of the museum shall have been completed, the Powell collection, which is at present stowed away, will be exhibited for comparison. Both collections may serve as a foundation for studies on the ethnology of southern Alaska and northern British Columbia. F. B.

MENTAL SCIENCE.

The Mental Powers of Insects.

ALONG with the introduction of scientific methods into psychology there was ushered in the comparative study of psychic phenomena. The interest was no longer exclusively concentrated upon human intellect, but the study of the minds of animals was shown able to contribute results of great value for many of the most important generalizations of a scientific psychology. Moreover, it has become recognized that we must not read into the actions of animals motives and conceptions suggested by our own conduct under analogous conditions, but must interpret the results objectively, and decide from the results whether our notions of the plan of animal behavior is valid or not, and to what extent. Among the problems included in such a scheme, the power of the senses is of fundamental importance; for these are the avenues of connection between the organism and the environment. The difficulty here is to devise tests that will yield a definite result. In ourselves we can always have recourse to the analysis of consciousness. Some recent attempts to shed further light on the senses of insects will indicate the scope and difficulties of the problem.

Forel, a Swiss naturalist and worthy follower of Huber, has added to his studies of ants by testing their sensory powers (*Recueil zoolog. suisse*, iv. No. 2, 1887; also *Centralblatt für Physiologie*, No. 23). Among his observations are some tests of the sensibility to ultra-violet rays. Do ants see these rays, or do they feel them (presumably as heat-sensations) through the skin? He blinded some ants by coating their eyes with a varnish, and found the behavior of such ants to be hardly distinguishable from that of normal ones. They probably retained some light-sensibility, for they preferred to remain in the bright parts of the nest. These ants are now put into a box with a glass top. On this top is placed a piece of 'cobalt-glass,' that transmits the ultra-violet rays of the spectrum, and next to it a frame with a glass bottom containing a solution of esculine that absorbs the ultra-violet rays. In addition, there is a dish of water over one portion of the top to weaken the heat-rays, and over another portion a sheet of cardboard to give shade. The position of these objects is varied, and from the congregation of ants under one or other of them he draws the following conclusions: (1) the ants see light, and especially ultra-violet, as Lubbock had shown; (2) they perceive it chiefly with their eyes, for when the eyes are varnished they are indifferent to the ultra-violet, and re-act only to a bright sunlight; (3) the dermal sensations are not as important as had been believed.

Another interesting point concerns the power of ants to recognize one another after long separation. In one species (*Camponotus ligniperdus*) the return of a number of its fellows to a nest after forty-one days' absence was followed by a fierce struggle, in which several of the new arrivals perished. After a few days, however, there was peace between them. It is to be noted that the blinded ants also took part in the attack. A second party was returned after eight days, and at once recognized and received as friends. But this is variable in the different species; cases being on record in which recognition took place after a year's absence, and again where the ants in the pupa stage, removed for only four days, were attacked.

The use of the antennæ Forel believes to be mainly as organs of smell. If the antennæ be cut off or coated with paraffine, the ants are incapable of pursuing their ordinary routine of life; while wasps, whose heads, including the eyes and pharynx, were removed, but with the antennæ intact, sought and found honey, and even tried, though in vain, to eat it. In insects using their eyes in the main, the antennæ are rudimentary, and such insects are inactive at night. Ants, too, have a sense of taste, preferring some substances to others, but are not able to distinguish poisonous substances. The effect of poisons varies in different insects. Arsenic kills gnats, while hundreds of *Myrmica scabrinodis* eat it without ill results. Strychnine does not produce cramps in ants, and they die of it slowly, while slight doses of morphine bring on severe convulsions. The sense of hearing, excluding the sense of jar, is very rudimentary, if it exists at all; while touch is highly developed, ants re-acting to the slightest contact. The same is true of their temperature-sense, as the changing of the position of the larvæ at different times of day indicates. Insects must be very insensitive to pain, or a spider would hardly eat up its own leg just after it had been cut off, as Forel observed. Ants are thus well supplied with senses, and, though their actions are largely instinctive, some control over the co-ordination of these instincts undoubtedly exists.

Another worker in the same field, Dr. H. C. McCook (*Proceedings of the Philadelphia Academy of Sciences*, part iii, 1887), contributes a note on the sense of direction in ants. The species is the *Formica rufa* of Great Britain, and the observation was made in Scotland. These ants build mounds as much as three feet high and from six to seven feet in diameter at the base. From such a mound, roads are seen to radiate. These roads are stained dark, probably by the action of the formic acid which the ants secrete; and the leaves and grass over which the road passes are worn smooth by the constant action of innumerable legs. From one such mound three roads radiated, and were traced to their termini, — three oak-trees, on the branches of which were *Aphides*, the 'milk-cows' of the ants. The directness of these roads was remarkable. The first was twenty-one paces (about sixty-five feet) long, and was almost perfectly straight from the nest to the tree. The second was twenty-three paces (seventy feet) long, and varied less than three inches from a straight line if measured from the nest to a point within two feet of the tree, where an originally straight path had been abandoned for a détour. The third road was thirty-four paces long; for six paces it ran straight, then encountered an old stump that caused a deflection, but then went directly to the tree, across a foot-path, and, as it was, the deviation was not more than three feet from a straight line. The straightness of these roads cannot be attributed to chance; and the fact that ants can see only a little way off (and especially in this mass of bracken and other plants) opens up a real problem as to the nature of a sense of direction in ants. Dr. McCook adds the mention of the remarkable feat of a Texas ant making an almost perfectly straight path 669 feet long, 448 feet of which ran under ground at an average depth of 18 inches.

THE FUNCTION OF THE CEREBRUM IN THE DOG. — In his last contribution to the physiology of the brain, the eminent physiologist at Strassburg, Professor Goltz (*Pflüger's Archiv*, 1888), gives an account of a dog from which one entire cerebral hemisphere had been removed. Here there was not, as some physiologists would expect, a paralysis and an anæsthesia on the side opposite the injured organ; but the action of the dog was quite normal, only that he preferred the side controlled by the intact hemisphere. This goes to show that in the dog one hemisphere can to a large extent perform the functions for the entire body. As a converse proof, if symmetrical regions are removed from both halves of the brain, the result is a much more serious one. An animal lacking both its frontal lobes had its intelligence much diminished, was restless, constantly moving, could not feed itself, could not hold a bone, and was a decidedly abnormal dog. A dog with both its occipital lobes gone shows marked sensory defects, but behaves much more normally than the former dog, thus indicating that the part removed is of vital importance.

A SUGGESTION FOR THE 'TELEPATHIC' THEORY. — Professor Josiah Royce has an apt word to say in regard to the cases of coincidence of a critical experience with a strong impression of danger on the part of a distant friend, which some regard as evidence of 'telepathy' (*Mind*, April, 1888). He offers as a solution of the many cases in which the evidence rests entirely on the word of a reliable witness, that the memory is the subject of a hitherto undescribed hallucination: it is an "instantaneous hallucination of memory, consisting in the fancy, at the very moment of some exciting experience, that one has expected it before its coming." As A learns of the death of B, it suddenly and vividly occurs to him that he expected B's death, and had a distinct presentiment of it. The belief might come with irresistible force, and acquire strength by reflection. One such hallucination of memory is well known: the feeling that an experience has been here before. Here we easily recognize the illusion, because we know that we do not live our lives twice; but in the other case no such corrective is at hand. If such illusions occur, marked instances of them should be found among the insane. Two cases are cited, the one of a young girl whose lover (so she says whenever any thing happens) predicted every thing to her, — her removal to another asylum, a change of physicians, and so on. The other case is that of a young man who believes that all the events of asylum-life have been told to him in a previous conversation. The news of the day is similarly anticipated. An interesting point in this case is, that the patient tells that when these (imaginary) conversations occur he pays little attention to them, but when the real occurrence takes place he vividly remembers the former conversation. His memory for real events remains quite good. Now that attention has been called to the possibility of such illusions, normal instances of them should be forthcoming.

ELECTRICAL SCIENCE.

Cost of Electrical Distribution by Transformers and Secondary Batteries.

THE attention of electricians, both in this country and in England, has been lately called to the relative values of continuous-current and alternating-current distribution. In the discussion before the English Society of Telegraph Engineers and Electricians, the majority of the speakers seemed to incline toward the alternating system, apparently relying to some extent on rose-colored reports of the successful working of plants on this side of the water. There were several members, however, who spoke strongly in favor of the continuous-current system; and one of them, Mr. Crompton, has published figures of the comparative cost of installing ten thousand 16-candle power lamps, burning simultaneously, using in the first case the continuous-current system with storage-batteries; in the second, alternating-current transformers.

WITH SECONDARY BATTERIES.

Motive power, six 166-horse power sets=996 horse-power at £8 12s.	£3,700
Dynamos	4,800
Building to suit above	8,000
Charging-main, 45 tons at £80	3,600
Laying main in culvert	1,500
Distributing-mains, 12,000 yards at 16s. per yard	9,600
Service-boxes, 450 at £2	900
Batteries, four sets of 50 cells each	8,640
Regulating-gear	1,000
Total	£48.740

WITH ALTERNATING-CURRENT TRANSFORMERS.

1,450 horse-power at £8 12s. per horse-power	£12,500
Dynamos and exciters	5,540
Buildings to suit above	11,000
Charging-main	2,400
Distributing-main, 12,000 yards at 14s. per yard	8,400
Service-boxes, 450 at £2	900
Regulating-gear	500
Transformers, assuming one large one for two houses, 300 at £25 (including fixing)	7,500
Total	£48,740

These estimates may be taken for what they are worth: they probably give an approximate idea of the cost of different items. The storage system of Mr. Crompton, however, is not a complete storage system, such as will be used if secondary batteries become much more economical than at present. The cells are not located at some distance from the station, and charged by currents of high electro-motive force: they are placed *in* the station, and are only charged for a portion of the twenty-four hours, the plant remaining idle during the remainder of the day. For short distances, such as Mr. Crompton contemplates, this is possibly the best arrangement. It would have been interesting if the running expenses of the two systems had been compared, but the necessary data are hardly, at the present time, available.

ADVANTAGES OF ELECTRICITY FOR RAILROAD-WORK. — The rapid advances of the application of electricity to street-car traction brings up the question whether we cannot in the near future look to the displacement of the steam-locomotive by the electric motor. The conditions of street-car and railroad work are different: in the first, electricity is called upon to displace horses, an extremely costly motive power; in the second, it must displace steam. That it can economically replace horses has been shown by a number of electric tramways at present in operation. The only question is, will considerations of safety and æsthetics allow the current to be economically conveyed to the cars? For instance: in the Sprague Electric Railway in Richmond, using an overhead conductor, it is costing for power about $1.70 per day per car, the cars averaging over eighty miles. This is for only twenty cars. When the full complement is running, the cost will be reduced, probably to about $1.50 per car per day. This cost is to be compared with the $5 or $6 that must be allowed per car per day for horses, at an average of, say, 60 miles per car per day. If the overhead system could be used, then, in all of our cities, there would be no doubt as to the results as far as street-car traction goes. When it comes to ordinary railroad-work, the state of affairs is very different. The question is, shall we substitute for steam, used directly, a power which is in the first place derived from steam, and which suffers the losses due to at least two transformations before it is utilized in driving the train? As far as mere economy of power-production goes, the question is easily answered: the efficiency of a stationary steam-plant is greater than that of a locomotive-engine; and the cost of a horse-power delivered to the driving-axles of the train by the electric motor would not be more for coal, attendance, and depreciation, than the same power from the locomotive, even after allowing for all the losses in the different transformations. The advantages of the electric motor are these: the driving-machinery is the simplest that it is possible to conceive of; the armature of the motor would be fitted directly on the car-axle, while the field-magnets would rest on the truck. Each axle would have its motor, and in a train every second or third car would be a motor-car. One advantage of this has been pointed out, first, probably, by Prof. George Forbes. Taking a six-car train, we would have the traction, not of four wheels, but of sixteen, supposing two motor-cars. This will enable us to make any speed that safety will allow, to start quickly, and to take at high speeds, grades that at present are inadmissible. In fact, we can dispense with a great deal of the grading that makes the construction of railroad-lines so costly. Again: on the down grades we can make our motors into dynamos feeding current into the line, — a plan due, I think, to Mr. Sprague, — instead of wasting energy by braking the wheels; and we can in the same way brake the cars when stopping. The advantages, then, are great simplicity, increased traction, allowing an increase of speed and a decrease in the cost of constructing the road, recovery of energy on down grades and in stopping. As compared with city electric tramways, such as are now in use, railroads would have the advantages of simplicity, in not requiring any gearing between the motor and car-axle, and in allowing any economical means of conducting the current to the car, and the employment of high electro-motive forces. There is one great disadvantage, however, that the future may remove, but which at present is serious. A station supplying any portion of the line will have to have a capacity equal to the maximum work that will be required of it at any time, while the mean work might be very much less than this. As the maximum may differ from the average work five or six times, we would have to equip stations of five or six times the present capacity of the locomotives, at a cost that would throw the balance in favor of the present system, unless there happened to be very considerable sources of natural power along the line. The remedy for this — a remedy which cannot be at present applied — is in equipping the stations with storage-batteries; charging them when the required power is below the average, drawing from them when it is above. We may say, then, that, with long-distance direct lighting and electric tramways, electric railways wait the development of a more perfect storage-battery to be successful.

ELECTRIC PHENOMENA PROVOKED BY RADIATION. — Very lately considerable attention has been attracted to the effect of light on the phenomena of electrical discharge, the light generally increasing the effects, allowing discharge where it would not otherwise occur. In the *Philosophical Magazine* for April, Professor Righi gives a preliminary account of some interesting experiments he is trying in the same field. Two metals, one in the form of a disk, the other a net, are placed opposite one another. One of the metals, A, is connected with one pair of quadrants of an electrometer; the other metal is connected with the other pair and the earth; and the needle is charged. If A is illuminated, a deflection is obtained which reaches a maximum in a time which is shorter the nearer the irradiating source and the larger the surface of the metals. The sun's light does not produce this effect in a marked way: the magnesium light is more active; the voltaic arc gives the best results. It is probable that the ultra-violet rays are the most active. Four of these 'photo-electrical cells' are connected in series, and give the same results as ordinary cells in series on open circuit.

HEALTH MATTERS.

Portagiousness of Consumption.

IN a recent paper presented to the Medical Press Association of St. Louis, Dr. William Porter discusses the 'portagiousness of phthisis.' He prefers the word 'portagious,' because it conveys a more exact idea of the manner of transmission of phthisis than either 'contagious' or 'infectious.' In his paper the term 'phthisis' is used to denote that class of disease to which belongs the large majority of cases of slowly progressive pulmonary inflammations; i.e., chronic tubercular phthisis.

Dr. Porter propounds the following question: 'Have we reasonable evidence that the products of, or emanations from, a phthisical subject may be carried to, received by, and cause like disease in, one previously free from phthisis?' The answer to this question he thinks must be answered in the affirmative, and quotes the following experiments as sustaining this view. In experiments made by Tappeiner in 1883, tuberculous sputa being inhaled by eighteen healthy animals, tubercles in both lungs, and pleura, were afterwards found in seventeen. That record of Koch's work found in the second volume of the 'Imperial Health Reports,' shows, that, after the inhalation of material from phthisical cavities, the rabbits and guinea-pigs under observation had, within twenty-eight days, tubercles throughout the lungs of all, and in the liver and spleen of some. The carefully conducted investigations of Cadeac and Mullet, recently published, show, that while no positive result was obtained from compelling rabbits and guinea-pigs to inspire air exhaled by phthisical patients, yet when air was used collected from near the beds of hospital inmates, the air presumably carrying particles of sputa, two out of twelve guinea-pigs acquired tubercle.

The writer refers to some experiments which he made, to determine this point. "Three healthy guinea-pigs were selected. One was inoculated with phthisical sputa, and placed in a small box with one of the others. The third was confined in a box in an adjoining room. They were cared for alike, and had similar food. In four weeks the first one died, and the examination showed tubercle in the lungs, and a large cheesy gland near the point of inoculation. Three weeks after, the second animal sickened and was killed. I found small granulations scattered through both lungs, at some points aggregated; and in the right lung were two nodules, having a soft cheesy centre. The third guinea-pig, examined three months later, had no evidence of tubercle or other disease."

The only experiment upon a human subject was made by Drs. Demet, Pararky, and Zallories, of Syra, in Greece, who inoculated, with sputa from a phthisical patient, a man whose history afforded no suspicion of tubercle, and whose lungs were healthy, but who had gangrene due to femoral embolism, and who would not permit amputation. In three weeks, auscultation revealed evidences of disease at the right apex. Thirty-eight days after the inoculation, the man died from gangrene, when it was found that the upper right lobe had seventeen small tubercles and two granulations in the apex of the left lung.

In an inquiry into the transmissibility of phthisis, made by the Collective Investigation Committee in London, two hundred and sixty-one answers were received from physicians in family practice, affirming the proposition that phthisis may be communicated from the sick to the well; and evidence was given in proof of the statement. One hundred and ninety-two observers recorded cases where both husband and wife became phthisical, in one hundred and thirty cases there being no phthisis in the family of the one to whom the disease was thought to have been transmitted.

Some of these cases were very interesting. Dr. Spriggs of Great Bedford instanced the case of Miss R., aged 48, a dressmaker, who, living in rather a lonely cottage at C., Bedfordshire, had three apprentices, young girls from seventeen to nineteen years of age, not related, from three adjoining villages, who took it in turn to remain in the house and sleep with her, each one week at a time. During their apprenticeship, Miss R. was taken with phthisis, of which she died. In less than two years afterwards, all three apprentices died of phthisis, although in the family-history of each no trace of phthisis existed; and the parents, brothers, and sisters of two are alive and well at this time.

Another interesting case was related by Mr. G. F. Blake of Mosely, Birmingham, in which a perfectly healthy child, with a family-history free from all trace of tubercle, was reported as becoming infected by a phthisical nurse, and having died with profuse hemoptysis, after the disease had run a rapid course.

Dr. Porter gives the following facts which have come under his own observation. He says, "In more than three hundred cases of phthisis, I have kept a record of the family-history, and find that fifty-one per cent of this number were of families in which some other case had occurred. The inquiry extended no farther than to first-cousins. Heretofore this would be accepted as evidence in favor of the heredity of phthisis, but I now believe that in many of these cases the disease was acquired by the carrying of the products of disease to a subject whose physical condition favored its reception and development. I recall the case of Mrs. L., in whose family was no trace of phthisis. Before her marriage, and for several years after, she was the ideal of a healthy woman. Two children were born. Her husband, a well-known city official, had phthisis. Her attendance upon him was constant, and for some months before his death she and the younger child were with him night and day. When called to attend him, I found that he had been substituting for the ordinary cuspidore a newspaper spread upon the floor at his bedside, and this would be loaded with sputa each morning. The case was rapid. The husband died, and within eighteen months Mrs. L. and the younger child also died from phthisis; while the elder daughter, who was comparatively little in the sick-room, still lives, and is well and strong. I have the notes of other instances almost as instructive, but this will suffice."

The author thinks that the disease may be conveyed in two principal ways, — first, by air carrying particles of disease into the respiratory tract; second, by food from infected sources, through the alimentary tract. In reference to these propositions, he says, "The first of these propositions is, I think, proven. Not only are the experiments and records here given powerful affirmations, but there is in the profession a steadily increasing belief in its truth which would require much more negative testimony than has yet been offered. I would not be misunderstood. I do not think that as yet we can sustain the statement that phthisis is contagious, — acquired by mere contact; or infectious, if the term be limited to imply a hidden subtile miasm communicating the disease: but I do hold that particles of matter from the site of disease in a phthisical patient may be carried, planted in suitable soil, and incite phthisis. I cannot think that all are liable to so acquire the disease. I would go further, and say that probably only those may so contract phthisis who have lowered their vitality through previous sickness or long watching in the sick-room, or those who have local congestion or inflammation in the respiratory tract. The fixation of a minute particle of dried sputum from a phthisical cavity, upon a point of irritation in the respiratory tract of a non-phthisical patient, may constitute an effective inoculation."

In reference to the second proposition, that phthisis may be caused by eating the flesh of tuberculous animals, or drinking the milk of tuberculous cows, he thinks this is to be received with the same limitations as the first; i.e., that there are conditions which favor the development already existing in the individual. He offers the following suggestions for the prevention of the extension of the disease: there should be frequent change of the atmosphere in the sick-room, complete disinfection of all clothing or vessels holding expectorated material; and the close confinement of any relative of, or attendant upon, a phthisical patient should be forbidden. He believes the day is at hand when the physician will recognize that it is as much his duty to examine the food that his patient eats, or the milk that is ordered for the sick child, as it is his province to see that the drugs he prescribes are pure and well compounded.

BOOK-REVIEWS.

The Nervous System and the Mind. By CHARLES MERCIER, M.B. London and New York, Macmillan. 8°.

THE announcement of the publication of this work raised great expectations, not alone because, in the interesting development through which the problem of the relations of body and mind is now passing, every promising contribution is certain to arouse great interest, but especially because any systematic treatise written somewhat from the psychological point of view is a great desideratum. The contents of such a work would be suggested by its function, which should be to serve as a propædeutic for the study of psychology, as well as to make clear to the general reader the position of modern science on this all-important question. Dr. Mercier's book does not fill this gap, nor was it intended to do so. His object is a simpler and a narrower one. Realizing the aversion of students of insanity to studies of the normal manifestations of mind, he is desirous of preparing for their special use a work that shall show how unscientific it is to attempt to restore a disordered mind to its normal functioning, without a precise and systematic knowledge of what those normal functions are. The object is certainly a most worthy one, and the more so because Dr. Mercier makes no secret of advocating the study of the philosophical aspects of mind on the part of medical students; not that he has any intentions of deluging them with metaphysics, but simply to impress them with the intimate relation of the problems with one aspect of which their specialty is concerned to the broad culture problems of humanity.

When we pass from the design to the execution, the work begins to be a disappointment. To enable the prospective reader of the work to judge of the validity of this verdict, a brief sketch of the contents of the book may be of service. The work contains three parts; the first treating of the physical and physiological functions of the nervous system, the second of its psychological functions, and the third of mind. Before starting upon the consideration of nervous function, we are gravely warned to bear well in mind the supreme and absolute distinction between mental and physical phenomena: the two are utterly heterogeneous, disparate, incommensurable; and all that we know is the parallelism that exists between them. With this distinction and this concomitance well impressed, the author is sanguine enough to believe that "the student will enter on the study of psychology with half his difficulties already surmounted." Under the head of the physical functions of nervous tissue, the cells and fibres are represented as molecules acted upon by a force, and the attempt is made, by the aid of more or less ingenious analogies, to demonstrate the possibility of the nervous system as we know it acting as the special agent of psychological functions. The most interesting and valuable portion of the book is undoubtedly that on the physiological functions of the nervous system; and much of this value is derived from the incorporation of Dr. Hughlings-Jackson's views on the interpretation of movements in terms of nervous discharges. The important distinction between 'central' and 'peripheral' movements is admirably described. On entering the psychological portion of the work, we feel at once the atmosphere that surrounds disciples of Mr. Herbert Spencer. As long as the general line of thought due to Mr. Spencer is applied to the evolution of conduct, or the ever-improving and more and more elaborate adaptation of organism to environment, the result is in more than one sense successful; but in the chapters on 'The Constitution of Mind,' on 'Thought,' on 'Feeling,' and in the three chapters on 'Classification of the Feelings,' the interest becomes a very formal and theoretical one, and amounts to little more than a digest of Spencer somewhat modified and elaborated. It will thus be seen that Dr. Mercier presumes a knowledge of the anatomy and physiology of the nervous system on the part of his readers, and wants to interest them in one particular aspect of their interpretation. This certainly does not appeal to the student of insanity. Not only does Dr. Mercier neglect to consider how very much of what he regards as most important is liable to be entirely modified by future research; but there is a vast and ever-increasing material from which it is being attempted by strictly scientific methods to build up a science of psychology that shall immediately appeal, by its intrinsic importance, to students of psychiatry, and of this development Dr. Mercier takes no account. This does not detract from the value of the work as a presentation of the 'dynamics of the human organism,' but it certainly does seriously lower its value to the student of mental disease or of psychology in general.

The great desideratum of a work on the relations of body and mind that shall do justice to all the various lines of advance along which research is progressing, and shall succeed in unifying the presentation thus given with perhaps a proper historic setting, remains for the work of another hand. Whether or not the time is ripe for such a contribution is certainly an open question.

Beiträge zur Geophysik. Abhandlungen aus dem geograpischen Seminar der Universität Strassburg. Ed. by Prof. G. Gerland. Vol. I. Stuttgart, Schweizerbart. 8°.

THE present volume is of great interest, even setting aside the scientific value of the papers contained in it. It illustrates the method of geography-teaching at German universities better than any elaborate description could do. As indicated in the title, it contains the results of researches of members of the geographical *Seminar*. The object of these institutions, which exist at every German university, is to teach students the methods of original investigation. The volume under review shows that this method leads to very valuable results. In the introduction, Professor Gerland gives his views on the aim and scope of geography. He is one of the few geographers who would exclude altogether what has been called 'anthropogeography' from the field of geographical researches. We believe that the author, one of Germany's most eminent ethnologists, was led to this conclusion by his intimate knowledge of the methods of ethnology. Recognizing that the latter are anthropologic, psychologic, or linguistic, he has no confidence in the generalizing speculations on the influence of the character of a country upon its inhabitants. On the other hand, he does not consider the methods of geology, so far as they are founded on paleontology, as the proper field of geographical studies. and confines the latter to the study of the problems of geophysics; i.e., the study of the physical and chemical forces as acting upon the earth. The essays contained in this volume treat exclusively this class of problems. Dr. H. Blink contributes an elaborate paper on the winds and currents of the region of the Lesser Sunda Islands, which he tries to explain according to Zöppritz's theory of currents and by considering the tides of this region. The influence of accumulations of polar ice during the glacial period is ably discussed by Dr. H. Hergesell. He shows that the changes in the levels of the sea are far too great to be explained by the attraction of polar ice and by the decrease of the amount of ocean-water, caused by their formation. The same author shows that it is extremely improbable that a river could reverse its course by the attractive action of the ice of the glacial period. The concluding paper of the volume is a discussion and compilation on submarine earthquakes and volcanic eruptions, by Dr. E. Rudolph, which is accompanied by very interesting maps. The author's discussion of the theory of the earthquake-waves is of great importance. These brief remarks show both that the volume contains papers of great importance, and the high standard of the work done in the seminary of the University of Strassburg. It may be expected that the subsequent volumes will be of equal interest and importance.

The Geological History of Plants. By SIR J. WILLIAM DAWSON. New York, Appleton. 12°.

THE student of plant-history will find in this volume a compact statement of much of our present knowledge of palæobotany, — a department of science in which the author has for many years occupied a distinguished position as an original investigator. A work of the kind here presented has long been needed, and cannot but meet with much favor from those who have earnestly and often vainly attempted to unite the fragmentary chapters that are found scattered throughout geological treatises and disconnected reports of learned societies. The individual chapters of the book before us not only treat of the geological succession of plant-forms throughout the various geological periods, but enter into a discussion of the structure of the more prominent types of fossil plants, geographical distribution, the conditions attending appearance and extinction, climatic changes, and the evolution of specific types.

The consideration of the theoretical questions constitutes the weakest portion of the work, and probably many will agree that the omission of much that it contains would have proved an advantage rather than otherwise. Professor Dawson apparently is still an anti-evolutionist, as the following quotation (p. 268), unfortunately of that character which bespeaks determined opposition to an idea, seems to show: "I can conceive nothing more unreasonable than the statement sometimes made, that it is illogical or even absurd to suppose that highly organized beings could have been produced except by derivation from previously existing organisms. This is begging the whole question at issue, depriving science of a noble department of inquiry," etc. And further, on p. 271, we find clearly stated his adherence in belief to "something not unlike the old and familiar idea of creation."

Sir William finds much difficulty in explaining non-variation through time on any evolutionary hypothesis of slow modification, and, as one of his *points de résistance*, refers to the oft-quoted identity existing between the plants of the Egyptian tombs and species now living, — a point which has also been forcibly insisted upon by Mr. Carruthers, president of the Linnæan Society; but why we should have expected to find a change in such a comparatively brief period is not stated.

Whatever position the author himself may hold in the matter of evolution, it appears more than likely that the intelligent student of his work will agree with a recent critic that "the evolution of species from species is apparent in every page of Sir J. W. Dawson's work."

Yankee Girls in Zulu Land. By LOUISE VESCELIUS-SHELDON. New York, Worthington. 12°. $2.25.

THE author tells the experiences of three American ladies travelling in South Africa in so charming a style and good humor, and with such vividness, that it is very pleasant and instructive to follow her on her adventurous expeditions through the Cape Colony and the Dutch republics. While her description of Cape Town, of its European, Malayan, and African inhabitants, attracts us, the book becomes even more interesting when she describes her journey by stage-coach from Beaufort to the diamond-mines of Kimberley, and the social life at this place. From Kimberley they visited Potchefstrom and Pretoria in Transvaal, which was at the time of their visit occupied by the English. The author describes the prevailing discontent, and is full of praise of the beauties of the Transvaal. She is equally enchanted by the inhabitants and climate of the Orange Free State. From here the enterprising ladies made a long journey by ox-wagon; and the character of the land, the violent thunder-storms and sudden floods, are so graphically described, that the reader will feel well repaid. The attractiveness of the book is principally founded on the simplicity of the manner in which the author's experiences are told. Although it is not filled with statistics and treatises on the forms of government, it creates, by the truthfulness of the descriptions, a vivid and instructive picture of the forms of life and state of affairs in South Africa.

Irish Wonders. By D. R. MCANALLY, Jun. Boston, Houghton, Mifflin, & Co., 1888. 8°. $2.

THE author, who paid a lengthy visit to Ireland, in course of which he traversed the island from end to end, has collected a considerable amount of Irish folk-lore, which he presents in this volume. Most of the tales are attached to certain places which the author visited, and, according to his statement, they are told in the same form in which the Irish story-teller told them: "Go where you will in Ireland, the story-teller is there, and on slight provocation will repeat his narrative; amplifying, explaining, embellishing, till from a single fact a connected history is evolved, giving motives, particulars, action, and result, the whole surrounded by a rosy wealth of rustic imagery and told with dramatic force an actor might envy." The story-tellers who told Mr. McAnally these legends mixed a good deal of politics with their tales, abusing the English landlord, and pleading for home rule. The author inserts the tunes and texts of a number of songs in his book, which are of considerable interest, the fairy dance on p. 26 being of particular value. The piano accompaniment of the song on p. 164 can hardly be approved. The book contains a number of legends referring to Satan and the saints, others on the pooka, fairies, and the banshee. It is of some interest to see how a good matter-of-fact fisherman has deprived the legend of 'Gray Man's Isle' of all that is wonderful. The book is of considerable importance as showing the remarkable transformation which legends undergo under the influence of modern ideas.

A Manual of German Prefixes and Suffixes. By J. S. BLACKWELL. New York, Holt. 16°.

THE present collection of German prefixes is designed as a practical aid to students of German, and meets this purpose very well. It gives to the student a clearer sense of the meaning of many German words than even the best dictionaries can do. The manual is founded principally on Sanders's and Grimm's dictionaries of the German language. The meaning of each prefix and suffix is defined very clearly; and the slight variations of sense conveyed by suffixes — as *-mässig* and *-gemäss*, or *-lein* and *-chen* — are shown by well-selected examples. As the book is designed for practical purposes, no attempt has been made to give the etymology of the prefixes and suffixes. The manual will be of great value to students of German.

Principles and Practice of Morality. By EZEKIEL GILMAN ROBINSON. Boston, Silver, Rogers, & Co. 12°. $1.50.

THIS work by the president of Brown University consists of the lectures which he has given in past years to his classes in ethics, and, as a text-book on the science, it has some decided merits. The style is good, to begin with, being clear and direct, and free from ostentation. The author is good-tempered also; and though he sometimes criticises other thinkers, and expresses his dissent from them in decided terms, he treats them all with eminent fairness. The book opens with a preliminary discussion of the object and scope of ethics; then follow a series of chapters on conscience, moral law, the will, the ultimate ground of obligation, and other topics in the theory of morals; and a brief account of the leading duties of man closes the volume. The chapter on the ultimate ground of obligation is, of course, the most important of all; and we are obliged to say that we do not find it satisfactory. Dr. Robinson examines the various theories that have been propounded by other writers, including the intuitional, the utilitarian, and others, all of which he rejects for one reason or another, and then gives it as his own view that the ultimate ground of moral obligation is to be found in the nature of God as a perfectly righteous being. But, surely, if we have no ground of obligation in our own souls, if such ground exists only in the nature of God, we can have no means of knowing that God is righteous. If the ground of right and duty is in God's nature alone, then when we say that God is righteous, we can only mean that he always acts according to his own nature; which might with equal truth be predicated of every thing else in the universe. We do not think that Dr. Robinson has contributed any thing to the solution of the fundamental ethical problem; and there are other points in his work to which objections might easily be raised. Yet it contains much that is suggestive; and it will doubtless be useful to students and also for popular reading.

A History of Political Economy. By JOHN KELLS INGRAM. With preface by E. J. James. New York, Macmillan, 1888. 8°.

A HISTORY of political economy in the English language was undoubtedly needed, for the existing works on the subject were by no means satisfactory. We have many good histories of practical economy in its various branches; but a good history of economic theories, such as Mr. Ingram here undertakes to give us, has long been a desideratum. In many respects this treatise is excellent. The author shows a very wide acquaintance with the literature of the subject in all the leading languages, and he has evidently given a great deal of study to all the various schools. He sketches in brief the course of economic thought in ancient and mediæval times, but agrees with all other writers in recognizing economic science as strictly a product of modern times. He remarks that the mercantile system was the natural outgrowth of certain social conditions acting on unscientific minds, and then proceeds to trace the origin and progress of scientific economics, beginning with the physiocrats and other writers of the eighteenth century. The leading contributors to the science are all passed in review, and the works of most of them well characterized. Unfortunately, however, Mr. Ingram is an extreme partisan of the historical school; and his partisanship has led him to underestimate the work of some of the great English writers, especially of Malthus, Ricardo, and Mill, whose defects he sees far more clearly than their merits. We find no fault with the author for treating his subject from the standpoint of his own school; but then he ought to do it in good temper, and without that irritation against men of opposite views which this book sometimes exhibits. Nevertheless, the work contains much valuable information, and will fill a useful place.

The Study of Politics. By WILLIAM P. ATKINSON. Boston, Roberts. 16°. 50 cents.

THIS little work is the introduction to a course of lectures on constitutional history, delivered by the author at the Massachusetts Institute of Technology. What particular benefit its publication will confer upon the general public we are unable to see. The book is written in bad temper throughout, with constant inuendoes against the men and classes with whom the author disagrees. It is mainly devoted to practical politics and the duties of citizenship, with very little in it that can be called scientific. Moreover, what Mr. Atkinson says about the corruption of public life and the duty of good citizens to engage in political work has been said so often by the newspapers in all parts of the country, that its repetition in a book at this late day seems to be unnecessary. If, instead of such matter as this, Mr. Atkinson had given us an introduction to the political and social sciences and to the proper mode of studying them, his work would have been of far more value.

A Manual of Physiology. A Text-Book for Students of Medicine. By GERALD F. YEO, M.D. 3d ed. Philadelphia, Blakiston. 12°. $3.

YEO'S manual was originally written to supply an elementary treatise on physiology for the series of students' manuals issued by this firm of publishers. Professor Yeo has succeeded in supplying a book which is well adapted to the wants of medical students. He has fully carried out the task which he undertook; viz., to avoid theories which have not borne the test of time, and such details of methods as are unnecessary for junior students. He has also omitted the history of the progressive steps in the growth of physiological science and the names of authorities, all of which would be but confusing to the student. In doing this he has taken care not to omit any important facts that are necessary to a clear understanding of the principles of physiology. The first edition, which appeared in 1884, being exhausted, a second has been prepared in which all important advances have been noted. The principal change which we observe is the entire revision of the chapters on the central nervous system, and their fuller illustration by means of drawings of the microscopical structure of the spinal cord. Yeo's manual has from the first stood in the front rank, but this recent edition will cause it to occupy a still higher position among the manuals of physiology.

Education in Bavaria. By Sir PHILIP MAGNUS. New York, Industrial Education Association. 12°.

WE hear a great deal about education in Germany, and not unfrequently overlook the fact that in matters of considerable importance the practice of the several German states is at variance. Prussia usually serves as the model for the rest, and but little attention is directed to Bavaria, Baden, Wurtemberg, and Saxony. As a member of the late Royal Commission on Technical Instruction, Sir Philip Magnus was led to make a careful examination of the educational practice in Bavaria, and it has been deemed of sufficient importance to be published as the second number of the Educational Monograph Series. Mr. Magnus suggests that the title is somewhat too general for the subject of which his paper treats; for his main object has been to show his English and American readers what is meant by a 'school system' in which each element bears a definite relation to all the others. The Bavarian school system is a typical one of these, in which organization and interdependence are pushed as far as they will go. The plan of the system is made very clear by an illustrative diagram. The paper is extremely compact, and does not lend itself to abridgment or condensation for the purpose of a review. It is to be warmly commended to all students of comparative educational methods, and will be found fruitful in suggestions. It closes with this significant sentence, which, while applied by the author to England alone, is capable of extension to the United States: "In the zigzag and indirect way in which progress is made in my own country, we are, I believe, approaching to a condition in which the State will exert more and more influence and control over secondary and higher education, and I am inclined to think that the change will be to the advantage of our schools, and, on the whole, a gain to our teachers."

Outlines of Practical Physiology. By William Stirling, M.D. Philadelphia, Blakiston. 12°. $2.25.

This work was written to supply the wants of the students at Owens College, Manchester, in which institution Professor Stirling occupies the chairs of physiology and histology. The experiments described are those which are performed by every member of the medical class, and are such as to illustrate all the important facts connected with human physiology. The book is a most practical one, the author having constantly borne in mind that "the student of to-day becomes the practitioner of to-morrow." The illustrations are numerous, well selected, and admirably executed. Taken as a whole, the 'Outlines' will be found to meet the wants of all teachers of practical physiology, not only in medical colleges, but in other institutions where such instruction forms a part of the curriculum.

Manual of Pharmacy and Pharmaceutical Chemistry. By Charles F. Heebner, Ph.G. New York, The Author, 5 Gold St. 12°. $2.

This manual has been prepared by the author to be used as a class-book or note-book by the students at the various colleges of pharmacy. It is not intended to take the place of lectures in pharmacy, nor to replace the many exhaustive works on this subject, but rather as a book to be used by those who have already gone over the ground, whether students or pharmacists, and who desire, either as a preparation for examination or for other reasons, to review the whole subject in a condensed form. For this purpose it seems to be well adapted, though its usefulness would be enhanced were it provided with an index in addition to the table of contents.

NOTES AND NEWS.

The prompt and favorable report of the judiciary committee of the National House of Representatives on the international copyright bill has greatly encouraged the friends of that measure. The passage of the bill by the Senate during the present session of Congress has not been in much doubt, although the consideration of it has been postponed from time to time on account of the urgency of other business. But the House of Representatives, it was feared, would hardly find time to deal with the subject. It may not now, but the unanimity of the committee, and the earnestness of some of the most influential Democratic members, in their advocacy of it, have greatly encouraged the friends of the measure. The bill may not become a law this year, but there is every reason to hope that the present Congress will not expire without its being placed upon the statute-book.

— The third field-meeting of the Indiana Academy of Sciences will take place at Wyandotte Cave, Crawford County, Ind., on Thursday, May 3, 1888.

— A few wild animals recently placed on exhibition near the National Museum in Washington form the nucleus of a zoölogical collection that may rank, as the museum does, among the most important in the country. Recognizing the importance of preserving at the national capital living specimens of the native fauna of this country, Mr. Beck introduced in the Senate, on Monday, a bill to establish a zoölogical park in Washington. The bill creates a commission, which is directed to secure one hundred acres of land bordering on Rock Creek, about one mile from the city, to prepare the grounds and erect suitable buildings upon it. The park is then to be turned over to the regents of the Smithsonian Institution for their future custody and care. The site indicated is one of the most beautiful in the District of Columbia. It is composed of rolling ground, with the beautiful Rock Creek flowing through it, and it is adjacent to Woodley Park, one of the most charming of the recent additions to Washington. A street-railway is already projected to it.

— Thomas Hampson, proof-reader and editor of publications of the Geological Survey in Washington, an active member of the Cosmos Club and Anthropological Society, and the working editor of the *Anthropologist*, a new magazine recently established by the latter organization, died on Monday morning, after a short illness. Mr. Hampson was a man of great experience and rare accomplishments, especially as a philologist, linguist, and grammarian. As a careful editor, he had few equals. He distinguished himself years ago in the Bureau of Education, and has fully met Major Powell's expectations since he secured his services for the National Survey.

— A Sydney (Australia) newspaper reports that in March the steamer 'Titus,' when in the vicinity of Cape St. George, on the south-eastern coast of Australia, encountered two heavy seas which rolled on board, and, immediately after, the decks were found to be covered with a matter resembling red sand. The seas flooded the decks and chart-room, but did no serious damage. The seas were probably caused by a submarine earthquake, which stirred up the mud at the bottom of the ocean; but the phenomenon described is a very unusual one.

— In order to centralize in a single focus all the results of studies devoted to African languages, Rev. C. G. Büttner, inspector of East African missions in Berlin, has founded a *Zeitschrift für afrikanische Sprachen* (A. Asher & Co., publishers), of which the first quarterly number has been issued. It offers a series of interesting documents, of myths, popular songs, and vocabularies; and the following may give an idea of the contents, most of which are laid down in the Lepsius missionary alphabet. *Chuo cha utenzi* is a long poem in an ancient Suahili dialect. The late Dr. L. Krapf, who transmitted it to the German Oriental Society in Halle, thought it was a translation from Arabian. It is written in the Arabian *talikh* script, and was transliterated by Krapf. The portion published in the first number holds 894 lines, but contains no translation. C. H. Richardson, a missionary among the Bakundu of the Cameroons, gives a short grammatical sketch of their language. J. G. Christaller, who formerly conducted missions on the Gold Coast, publishes myths concerning creation, origin of man, deity, cause of death, from different African nations, with interlinear translation, free translation, and linguistic notes. From Rev. Endemann we get song-texts of the Sotho people of a very curious description, and not comprehensible without the comments subjoined. Then follow small word-lists of two languages spoken near Kilima-Ndjaro Mountain and a specimen of H. Brincker's 'Dictionary of the Otjiherero and Objambo Languages,' now going through the press of T. O. Weigel, publisher in Leipzig. The first number contains only specialties, and of special knowledge all general knowledge and science are built up. This commencement augurs well for the future of the periodical, which is in scientific hands, and will encourage all the missionaries in that distant land to make their investigations public. The Germans and English are always busy in bringing the results of their scientific researches in linguistics before the public; while others, many Americans among them, are better known for their inclination to lock up useful material in their drawers and strong-boxes.

— Mr. L. D. Allen of New London, Conn., has deposited in the National Museum at Washington a number of Indian curiosities collected by his son, Mr. J. Isham Allen of Montana. Among them is a painted elk-skin once possessed by Pretty Eagle, a former chief of the Crows. It is covered with the figures of eight mounted warriors, and several on foot, all rudely drawn, but of bold and vigorous design. They tell of the victories of the chief over his enemies. There is also a war-bonnet, which is composed of the entire skin and down of a swan, and is ornamented with eagles' plumage and wampum. It was captured by a Crow chief from the North Assiniboins. Another article is a bow and arrow, the former property of a Crow chief, Bean-in-the-Water, and a medicine-horn made of a buffalo-horn, and ornamented with a white weasel's skin.

— A bottle thrown overboard near Pernambuco, Brazil, July 28, 1885, to assist in tracing the direction of ocean-currents, was found at Little Cayman, W.I., March 1, 1888, about thirty-two hundred miles from the starting-point. A note made upon this report at the Hydrographic Office, Navy Department, Washington, says that the bottle probably drifted along the Spanish Main into the Gulf of Darien, thence due north across the Caribbean Sea, passing around Jamaica between it and San Domingo and Cuba, and thence about west by north to Little Cayman, passing over a distance of about four thousand miles. Taking the average of the current at two knots an hour, the voyage occupied less than two and one-half months; so that the bottle was probably on the beach at Little Cayman more than two years before it was discovered.

LETTERS TO THE EDITOR.

**** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

Twenty copies of the number containing his communication will be furnished free to any correspondent on request.

The editor will be glad to publish any queries consonant with the character of the journal.

Formation of the Explosive Chloride of Nitrogen by Electrolysis.

ON the 14th of this month I made the discovery that the chloride of nitrogen, a dangerously unstable compound, is formed during the electrolysis of a solution of ammonium chloride (sal-ammoniac). The difficulty and uncertainty of its formation by electrolytic analysis will be understood when it is remembered that nitrogen chloride is the resulting product only when numerous powerful chemical affinities are in equilibrium.

The operation may be successfully conducted as follows: a saturated solution of ammonium chloride (temperature 7° C.) contained in a suitable apparatus is electrolyzed between platinum electrodes, care being taken to shield the solution from direct sunlight. After the decomposition has proceeded for some time, — chlorine being evolved at the positive electrode in minute bubbles, which are absorbed by the solution, — small particles of a light-yellow liquid, with a most peculiar oily appearance, will be observed to collect on the surface. These soon combine to form small globules, which sink slowly to the bottom of the vessel. If a warm solution be electrolyzed in a brightly lighted room, no such results will be obtained; the nascent chlorine decomposing the solvent water to form hydrochloric acid.

As this substance is one of a class of compounds which explode violently by a rapid dissociation of their constituent elements, the following precautions are necessary to insure safety: 1st, the temperature of the solution must not be allowed to rise above 10° C.; 2d, the apparatus must be of the strongest construction, scrupulously clean, and not exposed to an intense light; 3d, if a powerful battery is used, it must be disconnected from the apparatus immediately upon the formation of the first drop of the explosive; and, 4th, it is prudent for the operator to protect himself by means of globes and a strong mask.

The chloride of nitrogen as thus prepared is a highly volatile, limpid, oily liquid, with an extremely pungent odor. It evaporates rapidly when exposed to the air, producing an unwholesome vapor. The stability of this substance seems to be in an inverse ratio to the rapidity of its formation, the maximum of safety being attained by the production of about four drops an hour. If the electro-motive force of the battery be but little in excess of that required for complete electrolysis, the explosive may be allowed to collect in the apparatus, where it will be gradually and harmlessly decomposed by the electric current.

This dangerous compound was first prepared in the year 1811, by Pierre Louis Dulong, an eminent French physicist, during a series of experiments on the chlorine compounds. Owing to the serious injuries he received on that occasion, Dulong thought it best to keep the discovery a secret, lest others should be tempted to repeat his perilous experiments. This precaution had, however, an unfortunate result; as Sir Humphry Davy, a few years later having rediscovered the same compound, and being ignorant of its nature, was also injured by its violence.

In view of the fact that the salts of ammonia are present in the oxidizing liquids of so many electrical batteries in use at the present day, the subject has, I think, considerable practical importance. May not this dangerously explosive compound be formed, under certain circumstances, by the electrolytic actions necessary for the proper working of the battery? Perhaps some of the readers of *Science* will be able to furnish information on this point.

In the mean time I will continue these investigations to ascertain, if possible, the nature and quantity of the remaining products of the decomposition, the action of different solvents, and the results to be obtained by substituting other ammoniacal salts for ammonium chloride. I will also observe more closely the nature of the explosive, and its behavior when acted upon by high potential electric currents. WILLIAM B. HALE.

Clinton, Ontario, Can., April 18.

Indian Graves.

ON the 17th of April some men were employed in scraping out a cellar on West Oneida Street in Baldwinsville, N.Y., and threw out several Indian skeletons. The scraper broke these badly, especially the skulls, but yet some interesting facts could be observed. I was able to get tolerable horizontal measurements of two skulls; the circumference of one being 20⅝ inches, and of the other 19½ inches. But for being broken, another was in very fine condition. It was that of a young person.

That this was a case of horizontal burial seemed probable, but was made certain the next day by the careful opening of another grave a few feet away. In this case the skeleton lay with its feet to the north, the knees being drawn up; the hands were brought up to the neck; and, while the head lay to the south, the face was turned to the west, the body having been placed on its side. In previous gradings and successive ploughings, the earth had been partly removed and the skull shattered. The soil was of fine gravel and sand, sloping to the south, and on the hill a little to the north had been an Indian village. No relics were found with the bodies, nor do they seem common in these horizontal burials here.

This was on the north side of Seneca River. In the autumn of 1886 I witnessed the opening of another burial-ground in the village on the south side. The size, condition, and position of the skeletons were much the same, and I was able to make several careful measurements. This was close by a level site of an early Indian village, affording much earthenware. The soil was a clear sand loam, unmixed with gravel; but under almost every skeleton was a small stone. There were no relics; and, though the skeletons lay on one side horizontally, there was some coufusion, and apparently no attempt to face the west.

Four modes of Indian burial are known in Onondaga County, and possibly five. The oldest seems to have been the horizontal mode, not at full length, but with the limbs drawn up, and with no articles in the grave. In a single instance a kind of mound-burial has been found, where the bodies were laid horizontally, with some articles, and the earth heaped over them in a mound of considerable size. I was fortunate enough to get a picture of this before its removal. The third made was that of the early Onondagas, who entered the county early in the seventeenth century. Before they came into central New York, they probably used ossuaries, like the Hurons, but there are no known instances around their later homes. When the French entered Onondaga, the local mode was to put the body in a sitting posture, placing some articles with it. Under European influence, this gradually changed, and the burial was much as with us, a century ago. In other places there have been other modes, as in the burial of several, one above another, in Cayuga County, and reported circular burials elsewhere. One curious grave has been brought to my attention by Otisco Lake. In this were two kinds of paint, and two long tubes of light-green clay, resembling the green gypseous shales, with flint arrow-heads. Two skeletons lay side by side, and the rare relics point to an early day. W. M. BEAUCHAMP.

Baldwinsville, N.Y., April 18.

BOOK-NOTES.

— On the 1st of May J. H. Bates removes his Newspaper Advertising Agency into new premises in the Potter Building, 38 Park Row. During twenty-five years his firm has paid the newspapers of the United States and the Dominion of Canada, over fifteen million dollars in cash for advertisements sent them.

— Among the illustrations for the article on 'Modern Explosives,' in the May *Scribner's*, will be four fine wood-engravings of the Flood Rock explosion, made from instantaneous photographs, and also a view of the blowing-up of the schooner 'Joseph Henry,' at the Newport Torpedo Station, in 1884.

— Among the contents of this week's issue (No. 9) of *Garden and Forest*, are the following articles: 'The Forests on the National Domain;' 'Flowers in Winter;' 'The Shrubbery in Winter;' 'Last Year's Leaves,' by Dr. C. C. Abbott; 'How the Mangrove forms Islands,' by A. H. Curtiss; 'Certain Cone-eating Insects,' by Prof. A. S. Packard; 'The Kew Arboretum,' by George Nicholson; 'The Culture of Lilies;' 'Fruit Garden Favorites,' by C. A. Green; 'The Forest Vegetation of North Mexico, II.,' by C. G. Pringle; 'Flower and Fruit Pictures at the Academy of Design,' by Mrs. Schuyler Van Rensselaer.

Calendar of Societies.

Anthropological Society, Washington.

April 17. — James Mooney, The Funeral Customs of Ireland.

Biological Society, Washington.

April 21. — F. W. True, The Affinities of the White Whale; C. Hart Merriam, A Bat New to the United States, and New Localities for other North American Mammals; C. V. Riley, Notes on *Platypsyllus*; George Vasey, Foreign Trees and Shrubs cultivated in the District of Columbia, Part II.

Natural Science Association, Staten Island.

April 14. — Charles W. Leng, Water-Beetles of Staten Island.

Connecticut Academy of Arts and Sciences, New Haven.

April 18. — Simeon E. Baldwin, The Roman and American Law of Undutiful Wills.

Engineers' Club, St. Louis.

April 18. — S. Bent Russell, Thickness of Water-Pipe, with Some Experiments on Ram.

SCIENCE.

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SCIENCE

FRIDAY, MAY 4, 1888.

THE SUGGESTIONS which Dr. Gouverneur M. Smith makes, in an article contributed by him to the *New York Medical Record*, an abstract of which we give in this number of *Science*, are most excellent, and, so far as we are able to judge, are also entirely practical. The two things which are especially lacking in the lives of those who live in tenement-houses are fresh air and sunshine. This is especially true of the invalids, so many of whom are found among the poor and unfortunate of all large cities. While those of this class who have health and strength may find recreation and an opportunity to expand their lungs in the parks, the sickly ones must remain, often year after year, in the confined, and not infrequently dark bed-chambers of a thickly populated tenement-house. Many such could be transported to the roofs, while they could not be taken to the public pleasure-grounds; and if these were so constructed as to admit sunlight and fresh air, and at the same time to exclude the wind and the rain, and were made attractive by the presence of a few flowering plants, the results could not but be beneficial, and repay a thousand-fold the money expended in making the necessary alterations. There is at the present time one serious impediment to a general adoption of such a plan. The sewer-system of New York, and of other cities as well, contemplates the extension of soil and waste pipes of all dwellings to the roof, so that the foul air, produced by the decomposition of the filth which they carry, may find a ready escape into the outer air, and not obtain an entrance into the dwelling-rooms. In many cases these pipes are trapped from the street-sewer, in many others they are not; and in either case the gases which escape at the roof are offensive, and undoubtedly detrimental to health. The writer recalls a case of continued fever, which was contracted by a young man, who, unable to leave the city during the summer, was in the habit of spending his evenings on the roof of his dwelling. The soil-pipe, untrapped from the sewer, extended above the roof, and the odors which escaped therefrom were often so offensive that he could not remain on the roof with comfort. In a thickly settled tenement district this evil would be greatly magnified. In the elaboration of any plan, therefore, for the arrangement of the roofs of our city houses so that they may be utilized as pleasure and health resorts, this important element of ill health must not be overlooked. We shall be glad to open the columns of *Science* to the discussion of this subject, and to reproduce any feasible designs which architects or others may devise for the carrying-out of the plan suggested by Dr. Smith.

THE FRENCH EDUCATIONAL WORLD is discussing with interest a recent innovation at the Collége de France, to which we have already referred in *Science*. That institution, ranking as the representative of the higher education, and having connected with it some of France's most eminent scholars, has converted a chair at the college into a chair of 'experimental and comparative psychology.' This is a very high tribute to the new psychology, and this illustrious example will, it is hoped, induce other institutions to take a similar step. M. Paul Janet contributes an extensive article in the *Revue de Deux Mondes*, outlining the interests which the new professorship is to represent. and defending it against certain misrepresentations to which it has been laid open. The occupant of the new professorship is Th. Ribot, whose name is well known to English readers, and all of whose works have been translated and editions published in America. His three monographs — upon the 'Diseases of Memory,' the 'Diseases of the Will,' and the 'Diseases of Personality' — are most admirable introductions into the studies with which they are concerned. His work upon the psychological aspects of heredity is of standard value, and his compilations of the systems of English psychologists and of German psychologists are hardly less serviceable. M. Ribot will in his new sphere be able to still further widen his useful influence by imparting to young men the same enthusiasm and liberality of thought which he has shown in his works, and nowhere more than in his able editorship of the *Revue Philosophique*, whose founder he is. The opening address of his course Professor Ribot (*Revue Scientifique*, April 11, 1888) devoted to a brief survey of psychological work in Europe and America. He finds everywhere encouraging examples of good work by scientific methods, and draws a very hopeful picture of the strides that this young science seems destined to make in the near future. The step that the Collége de France has thus taken is an indication of the *raison d'être* which scientific psychology has already proved for itself; and a similar reform is doubtless to take place elsewhere. It is gratifying to add that the educational institutions of this country are beginning to realize the propriety of such a step, and of having a representative of the new psychology in their faculties.

NO DEPARTMENT OF PHYSICAL RESEARCH is more fascinating to the biological investigator, or more transcendently important to the human race, than that one of comparatively recent development, the study of micro-organisms and of their agency in producing disease. It is to be regretted that Dr. Sternberg, who was employed by the government to make the inquiry in regard to the existence of a yellow-fever germ, and the feasibility of securing protection from that dread disease by inoculation, was not permitted to pursue his investigations to a more satisfactory conclusion. His report, as it is, will be a very important one, although it will afford no encouragement to those who are striving to account for every known disease by the germ theory, and to look to inoculation as a preventive.

A VERY INTERESTING FEATURE of the Washington experiment in manual training in the public schools, a brief account of which is given elsewhere in this issue of *Science*, is the great amount accomplished with a small amount of money. The sum available for the current school-year, aside from the salaries of teachers, was only five thousand dollars. With this, four carpentry-shops, two schools of cookery, and one turning, moulding, and forging shop, have been fitted up, the last with a steam-engine, shafting, etc.; and all the material used in them, and in the teaching of sewing to the girls in all the grammar grades, have to be paid for. The number of pupils, boys and girls, enrolled in the two higher grades of the grammar-schools in which it has been attempted to introduce manual training, and in the High School, was last year 3,807, and it is probably a little larger this year. The number of the pupils comprising the manual-training classes is 1,243. It is true that the most of these are receiving only one-half as much instruction as is desirable, and that a much larger amount of material could be used to advantage; but the fact that Superintendent Powell has accomplished so much with so small a sum proves that the expense of making an experiment in manual training in connection with the public schools, at which so many cities have hesitated, need not deter them.

THE PECUNIARY ECONOMY OF FOOD.

UNDER this attractive title there appeared in the January *Century* an article from the pen of Prof. W. O. Atwater, in which he propounded to the American people this question : —

"Is not the American, of all civilized men, the most wasteful, and is not his worst wastefulness in his food — and drink?"

This question comes closely home to nearly all classes ; no more to the coal-laborer who made his boast, "No one can say that I do not give my family the best of flour, the finest sugar, the very best quality of meat," than to the affluent whose every desire can be gratified without pecuniary embarrassment.

Said a millionnaire to two young merchants, "If you cannot afford to eat mackerel, eat herring." Therein was hidden the secret of his success in acquiring fame and fortune. His wife was his co-laborer, a rigid economist, and yet she confesses her inability to overcome the wasteful habits of her kitchen servants.

Even those who preach the doctrines of Him who bade His disciples "gather up the fragments that remain, that nothing be lost," are wasteful.

A butcher in Philadelphia who has been supplying the laboring-class with meat for a number of years, informs me that five years ago there was a quick sale for all the cheap cuts, but now so universal has the habit become of buying the more expensive cuts, that there is no market in his neighborhood for low-priced meat.

A former president of the West Washington Market Association stated that it is the impecunious class that is most exacting regarding their meat-supply. They demand the most expensive cuts, while people in possession of an ample competency study economy in the purchase of their supplies.

In a neighborhood where the Scotch laborer predominates, I am informed that they buy the cheaper cuts, and make the most economical use of them, while the Irish in the same locality are universally wasteful. A gentleman formerly prominent in the Massachusetts State Board of Health, and of extended experience in studying all subjects connected with food, states that no greater truth has been uttered before the American people in recent years than that made by Mr. Edward Atkinson, that "if the people of this country would knock the bottom out of the American frying-pan, they would have one-third more money to spend for rent than they now have."

We plead guilty. Are not American dogs sleek and fat? Wherever there is a profusion of food, there you will find fat dogs ; while in countries where the supply is scant, or where economy in food is compulsory, dogs are lean and hungry ; for instance, as in Turkey.

We confess that there is, on the part of the average American and his imported allies, a prodigious waste of food, — in its purchase, its preparation and use.

"O wad some power the giftie gie us,
To see oursels as ithers see us !
It wad frae monie a blunder free us,
And foolish notion."

These lines prompted us to put the above question to a Frenchman, for many years master of the household of one of the crowned heads of Europe, a professional cook, a man of extensive travel, and at present, as for several years past, engaged in this country in the preservation and manufacture of food-products. And thus he replied : "Is there waste? Yes, in all directions. I never saw any thing like it. Tables are overloaded. There is too much of every thing. This waste is most notable at hotels, where it is so marked as to be ridiculous.

"You Americans seem to take very little pleasure at the table. You gobble up your food, or else take it as if it were medicine. Then there is no variety to the American table. A few articles are served day after day. Your *ménu* is the same everywhere, — beefsteak, ham and eggs, pork chops, sausages, pancakes, and pie. Last summer, in a trip to Bar Harbor, my daughter kept an account of the number of times beefsteak appeared upon the table, reporting upon her return that seventy-two times it was the main article served. In France the higher classes thoroughly understand the value of food. There is no waste, no loss in the kitchen. The clean remnants from the tables of the higher classes are purchased, overhauled, and sold in the market to the poorer classes, who waste more than the better, largely through ignorance. In France it is considered sufficient to serve one kind of vegetable with meat; but here in the United States, if four or five sorts are in season, you will be pretty certain to find three or four of them upon the table at once. Bad cooking is one reason for this great waste. The art of using the unsoiled remnants from a meal is not understood. These can be prepared in many ways, and so nicely disguised as to come to the table a second time in an attractive manner. Americans fail in this respect, because in the first cooking of meat it is overdone, so that, when subjected to a second cooking, it is made unpalatable. Faulty carving has also much to do with the universal waste of food."

Is this waste wilful? We are not prepared to answer affirmatively, or to indorse the statement that Americans are indifferent, and manifest an aversion to food-economizing. Waste may be, as claimed, epidemic in the United States ; but it is not so through universal ignorance, although a portion of it may be so charged. That seems like a libel on the thrift and industry of the early settlers of New England, whose work and influence are felt throughout the United States. In new countries, where the reward of industry is unusually liberal, time is of great value. In Australia, where fortunes are made quite as rapidly, if not more so, than in this country, there has been a prodigious waste of food. There, as well as here, time is of greater value than in continental Europe.

There is no true economy in saving twenty-five cents' worth of nutriment when the time it requires is worth in other directions a greater sum. Many waste food because they will not or can not take the time for the proper preparation of the cheaper sorts. To make the most economical use of food requires time and trouble. It is easier to broil the toothsome sirloin or porter-house than to boil or stew some cheaper cut. We find that the wife of the coal-laborer who furnished his family the best of every thing on seven dollars a week, "had to cook before six in the morning, or after half-past six at night, because she worked all day in the factory." Her time was worth more in the factory than in the home. This probably accounts in some measure for the waste on the part of wage-earners, the balance being attributed to ignorance, or, as Professor Atwater puts it, "innocently committing an immense economical and hygienic blunder."

This waste, so common to Americans, seems an anomaly in view of the fact that in every direction the laborer is taught by the capitalist that it is only by the most rigid economy that profit is gained. Thus we find that a huge monopoly, as the Standard Oil Company, is constantly demonstrating to its laborers that ninety per cent of the crude oil received is manufactured into products having a commercial value. In the large hog-slaughtering houses throughout the United States, it is said that every thing connected with the hog except the squeal is saved. In the large abattoirs even the blood is saved, and utilized for fertilizing purposes.

It is by giving a commercial value to the little things which a few years ago were wasted, that large corporations are enabled to pay dividends. And yet, with this economical lesson constantly before all wage-earners, there goes on an enormous waste of food. The capitalist who enforces economy in his factory is in his house as much a sinner as his uneducated workman. Can it be accounted for in any other way than that time in the United States has a greater value than in any other country, and that at this period of our history it is worth more in other directions than in demonstrating the pecuniary value of food? That eminent student of economic science, Mr. Edward Atkinson, says that nowhere else are the products of labor and of capital so adequate and so ample as in the United States, and that nowhere else are wages and profits so high.

"Necessity is the mother of invention," and therefore we believe that when time is of less value in the United States than at present, and there is greater necessity for economy in the use of food, the average American will lead in getting the maximum amount of proteine at the minimum of cost.

This waste can be and is being checked. It is not as great as it was twenty years ago. The press fairly teems with books and journals devoted to household economy. There is an enormous demand for this sort of literature, so great that every newspaper devotes space to the subject. Through these mediums, the cooking-school and the instruction in cooking in the public schools, the people, and especially the rising generation, are being taught the pecuniary value of food. The mass of the people do not realize the extent of waste now going on. It can be more fully brought to their attention when the pulpit seconds the press, and the preachers themselves learn the pecuniary value of food, and urge it upon those to whom they minister. When we are taught that it is sinful to waste, we shall be more apt to imitate the French, and have a greater variety of food, at less expense, with more leisure for the economical housewife.

Since 1865 the United States has led all other countries in the preservation of food in hermetically sealed tins. Every variety of soup, meat, fish, poultry, game, fruits, and vegetables is available at any season of the year.

The people are very rapidly learning "the pecuniary economy of such food" as compared with a like quantity of the same articles in a fresh condition. For instance: a one-pound can of the finest salmon in the world, packed on the Columbia River within a few hours of the time the fish is captured, costs the consumer 20 cents. He is thus enabled to secure nutrients at a cost of 55 cents per pound, which in fresh salmon at 35 cents per pound, as ordinarily obtained in city markets, would cost $1.40 per pound. Until recently this has been appreciated to a far greater extent in England than here. In this country, five years ago, there were consumed 16,000,000 tins of salmon. Since then each year has recorded a rapid increase in the quantity used, until last year 24,500,000 tins, or more than one-half the supply, were taken for home consumption. England is the chief buyer of American tinned meats, simply because consumers at home do not fully realize that a greater amount of nutriment for a given sum can be obtained in that way than from a like quantity of fresh meat at a far greater cost.

The waste of Southern cotton-fields is now being transformed into wholesome and cheap food, and destined, as W. Mattieu Williams believes, to take the place of lard as a frying-medium. We need not further specify in order to prove, that, as a people, we are making progress in the direction of checking waste, and that as population becomes more dense, time of less money-value, and the necessity for economy greater, we shall master the full meaning of 'the pecuniary value of food.' F. N. BARRETT.

ST. PETERSBURG LETTER.

RUSSIAN chemical literature has been enriched this winter by two considerable works, though of unequal value, — Mendeleef's work on solutions, and Menschutkin's 'Essay on the Development of Chemical Theories.' In the former book the celebrated Russian chemist gives a considerable account of his own work, together with a clear exposition of the views of other chemists. I cannot attempt to analyze it here, but mention only that he formulates some simple laws in this matter, which will undoubtedly be accepted by the scientific world. Menschutkin's book leads us from the phlogiston theory to the views of the present generation of chemists. The last chapters are the best. The author has for some years been engaged in the arduous task of measuring the time and other conditions of chemical re-actions. The second edition of Beilstein's 'Handbuch der Chemie,' published, like the first, at Leipzig, is rapidly advancing. Though rather a compilation, it is an exceedingly useful book, and it is scarcely credible that it should be the labor of one man. The author has been for more than twenty years professor of chemistry, and director of the chemical laboratory of the Technological Institute at St. Petersburg.

Professor Mendeleef received a short time ago an official mission to the Donetz coal-basin. The mine-owners petitioned for it, representing that his work on the petroleum question proved him to be equally competent in the scientific and economic aspect of it.

Russia has to deplore the early death of a man who has already done much for science, and could be expected to do more, — the zoölogist M. Bogdanow, professor of zoölogy at the University of St. Petersburg. Born in 1841, educated at the Kazan University, where he finished his studies in 1864, he came to St. Petersburg in 1871, and remained professor till his death, March 16, 1888. Mammals and birds, and their geographical distribution, were his principal studies, especially the latter. His two greatest works are, 'The Birds of the Caucasus,' published in 1885; and 'Russian Ornithology,' the first part of which appeared in 1885. He travelled extensively, especially in eastern Russia, the Caucasus, and to Khiva and the surrounding deserts, and gave some of the best descriptions of these countries to be found anywhere. For some years he was very much interested in economic zoölogy, especially in the breeding of domestic birds. As professor he was exceedingly popular, and some of his pupils have already done good work.

The results of the past 'geographical campaign' were not brilliant, as no first-class geographical expedition was in the field. It is to be hoped the current year may give more. General Prejevalsky is here, and hopes to start again for Tibet in August or September, 1888, to equip the expedition, buy camels at Karakol, near Lake Issyk-Keel, and then go via eastern Turkestan. A money-grant from the government will certainly not be refused for his expedition, on account of the high scientific character and political importance of the former.

He has brought with him the manuscript of the narrative of his fourth journey, which is soon to be published. As to the special reports on botany, zoölogy, etc., they are in the hands of specialists, and some of them will take considerable time.

Potanin is now at Irkutsk, having accepted the position of secretary of the East Siberian branch of the Russian Geographical Society. He is occupied in writing the report of his last extensive journey to western China, Mongolia, etc., and is not likely to start very soon on a new expedition.

As to the work of the Russian Polar Commission, the report on terrestrial magnetism at Sagastyr, at the mouth of the Lena, will soon be issued, while the additional observations will not be issued until some years later. The reason is, Lieutenant Jurgens has been ordered to embark for Vladivostok, and will have no time for the discussion of the Sagastyr observations for two or three years.

The council of the Imperial Russian Geographical Society have decided to grant money for the fall expedition in 1888: Kousnezow to the northern Caucasus, Kossikow to the south-western Caucasus. Both will study the glaciers. The latter goes principally for studies on mammals and birds. Adrianow will go to the Altai, Colonel Grombtschewsky to the Pamir, Listow to the Crimea, where he did good work in 1887. An expedition which is not entirely decided upon is that of the astronomer Baklund, and geologist Kudriawtsew to the Kola Peninsula. The geologist Iwanow, well known for his explorations of the Pamir, is to start in a few days for Vladivostok, for a two-years' exploration of the vicinity, the Sichota-Alin Mountains, and southern part of the Ussuri basin, the principal aim being the discovery and exploration of coal-mines.

The Meteorological Commission of the Geographical Society is doing good work, and now organizing some stations which will make observations which may be useful to agriculture; viz., actinometric, and on the temperature of the soil from the surface to a depth of two metres. The most interesting of these stations is that proposed at Sultan-Bend, on the Murghab River, south of Merv, where a great dam is to be built across the river, and the water retained to irrigate 300,000 hectares of the most fertile land. Extensive cotton-culture is contemplated on the land thus redeemed from barrenness, as in that country no culture is possible without artificial irrigation.

The depression of agriculture and low prices are the topic of the day, and often discussed in more or less learned societies; but it would be difficult to give a brief account of them, and most of the discussion is of no scientific value.

The season from January to the middle of March has been a rigorous one also in the north of Russia. The frosts were remarkable for their persistency more than for their rigor. From the 7th of January to the 22d of March there was no thaw at St. Petersburg, yet the air-temperature did not sink below —29° C. It fell much lower in February, 1867 (—33.5°); January, 1868 (—38.0°); February, 1871 (—36.3°); and December, 1876 (—37.6°). It sank below —30° even in March, 1867 and 1877.[1] For many days in January, February, and March the coldest region was southern and central Finland, the cyclones passing south of it. Thus in the north we did not have the fearful snow-storms which were experienced nearer to the centre of the cyclones in central and southern

[1] In all these cases not the minimum temperature, but the lowest of those observed by observations made thrice a day, are given.

Russia as well as in Germany, where traffic was blocked for many days. Now it is often stopped on account of the melting of the enormous amount of snow accumulated in winter. Destructive floods have already begun, especially in Hungary and Galicia, and will extend northward and eastward as the season advances.

O. E.

St. Petersburg, April 2.

SCIENTIFIC NEWS IN WASHINGTON.

Manual Training in the Washington Public Schools. — Dr. Sternberg's Investigations in Regard to the Yellow-Fever Micro-Organisms. — Production of Copper, Lead, and Zinc.

Manual Training in Washington.

A YEAR ago Congress appropriated five thousand dollars to be used during the present fiscal year for the experimental introduction of manual training into the public schools of Washington, in accordance with a plan outlined by Prof. W. B. Powell, superintendent of schools of the District of Columbia. Industrial drawing had been introduced into the schools six or eight years ago. Beginning with moulding in clay and stick-laying and the study of the forms represented, the pupil is advanced, during the eight years of the course below the High School, to constructive drawing, free-hand and instrumental; to making working drawings of the hollow cylinder, of the bolt-head, of the bell, of the pulley, of the try-square, and of framing (the mortise and tenon); to the making of conventional ornaments, drawing plant-forms from nature and adapting them to ornament, etc. Professor Powell's plan was to supplement this by making work in shops a part of the regular course for the boys in the two higher grades of the grammar-schools and in the High School, and in the same way to ingraft instruction for the girls in cookery, upon the same grades.

With the funds provided by Congress there were fitted up, at the beginning of the present school-year, two schools of cookery, four schools of carpentry, one school of turning, moulding, and forging, and one school of sewing. The cost of furnishing and equipping each school of cookery with chairs, table, washstand, cupboard, dishes, range, boiler, and fittings, was $202.20; that of each school of carpentry, for benches, tools, lumber, and nails, a little less than $400; and that of the school of turning, moulding, and forging, including moulding tools, forges, lathes, and tools for same, shafting, belting, pulleys, and fittings, and steam-engine, $1,800.29. The estimated cost of materials for all of these schools for the current school-year, the estimate being based upon the actual expenditure to Jan. 1, is $631.53. Eight teachers are employed, — two of cookery at $500 a year each; four of carpentry and one of turning, etc., at $650; and one of sewing at $700. The teachers of carpentry, turning, and forging are all graduates of the Worcester (Mass.) Polytechnic Institute, specially trained to give this kind of instruction; and the teachers of cookery are graduates of the Washington Normal School, who have taken a special course in cookery under the supervision of Superintendent Powell.

The number of pupils now under instruction, drawn from the seventh and eighth grades of the grammar-schools and from the High School, is as follows: in the schools of cookery, 471; in the schools of carpentry, 660; in the school of moulding, turning, and forging, 112; in the school of sewing, 600. These schools, except the sewing-school, the instruction in which is given in the regular classrooms, are divided into classes of about twelve pupils each, which succeed each other during each school-day at intervals of one hour each. Every class, therefore, has one hour's instruction in the shops each week. It is Superintendent Powell's desire to increase this to two hours a week as soon as sufficient funds are available, and shops have been provided for all the pupils in the grades mentioned. In the cooking-schools, each lesson consists of instruction in the chemistry of foods and cooking, in the relative nutrient qualities of different articles, in the selection of food at the markets and the groceries, and in the practical preparation of one dish. During the week intervening between the lessons, the pupils are requested to make a trial of the dish last made, and to report success or failure.

The interest of the pupils in this work is very great. The teachers have been surprised to find how many of the girls in the two higher grades of the grammar-schools and in the High School are entirely ignorant of even the plainest cooking. This is true not only of the daughters of wealthy parents, but of those of families of small income, like clerks in the government departments. In a large majority of cases no instruction at home seems to have been given the girls in the public schools. Again: the more wealthy parents are, as a rule, the more anxious that their daughters shall join the classes in cookery. Some of the pupils at first objected to washing the dishes and making the kitchen ready for the next class, but this false pride has already disappeared. A healthy emulation has sprung up among the girls of each class to be able to report the most successful experiments in cookery at home; and in many a family in Washington an improvement in the methods of preparing food has already taken place, as a result of the few months' instruction that has already been given.

The schools of carpentry are also divided into classes of twelve pupils each, and the course comprises two years' instruction. During the first year the boys in the seventh and eighth grades of the grammar-schools are practically taught the correct methods of using planes, handsaws, chisels, gouges, brace and bits, hammer, gauge, and other tools in the working of wood; the laying-out of work with knife and pencil, using try-square, bevel, and dividers, and working from drawings executed by the pupil himself; the making of plain and more complex mortise-and-tenon joints; dove-tailing and plain cabinet-making; the making of articles of practical utility for the schools and shops; the putting-together of work with brads, nails, screws, and glue; the care and sharpening of edged tools; and the use of circular saws.

A visit to the schools of this grade showed wonderful progress during the few months since they were established, and this progress was especially striking when some of the earlier work was compared with some of the later. In one of these schools, each pupil was engaged in making a shoe-blacking box. The designs were all original, and no two of them were alike. Some of them showed considerable invention in the form and arrangement of the boxes. Working-plans had first been made, and submitted to the teacher for his approval, and every pupil was required to construct his box in accordance with the plans submitted. The work was well advanced when seen; and some of it would have been highly creditable to a skilled cabinet-maker, while the average of it all was certainly as high as that which would be done by the average Washington mechanic. Benches for use in the shops, shelves and cupboards for the use of the schools, geometrical blocks for the primary schools, and many other articles, had already been made by the classes of this grade.

In the turning, moulding, and forging shop the boys from the eighth grade of the grammar-schools and from the High School are taught the use of all the hand wood-turning tools, embracing plain and fancy turning in hard and soft wood, inside and outside; the use of chucks and face plates; pattern-turning; bench-moulding in sand; casting soft metal, embracing the use of slickers, trowels, riddle, etc., using patterns made by the pupil himself; the forging of small articles of soft iron and steel, and steel tools, with instruction in the simpler methods of manufacture of iron and steel; practice in welding iron and in hardening and tempering steel, and by lectures on metallurgy.

It is the intention to give each class two hours of practical instruction a week; but, owing to the small number of shops and the limited number of teachers, they are receiving but one hour a week this year. But their progress has been very satisfactory. The work in turning, moulding, and forging, while showing great differences of adaptability on the part of the pupils, proves that every boy is capable of learning to use common tools, and of making with them a thousand and one articles which, before the few lessons he has received, he would not dream of undertaking. Among the useful articles already made in this shop are a set of filter-stands for the physical laboratory of the High School, handles for tools, etc.

The interest of the boys in the work of the shops is as great as that of the girls in cookery. They are all bright, wide awake, and there is no listlessness, no idling the time away. As all the members of each class are engaged upon similar work, there is a healthy emulation among them to produce the best results. It is also noticeable that the wealthier parents take more interest in these shops than those in more moderate circumstances, and, as a rule, desire that their sons shall have the manual training, even though they intend to enter professions.

What is claimed for the Washington experiment is, that it is an attempt to ingraft upon the common schools a system of manual training that shall give to all the boys a practical knowledge of the use of the most common tools used in working in wood and iron, and to all the girls a similar knowledge of plain cooking and sewing. This it is intended to do without interfering with the regular studies; each class, when the schools are completely organized. devoting two hours a week to the manual training.

The shops in Washington have not been established long enough to make it possible to determine whether the experiment will be successful or not. The only thing that can be said of it is that the results thus far seem to be encouraging. Of the single school of carpentry established in the High School last year, and attended by 225 pupils, Superintendent Powell says, "The work was successful. It was not difficult to manage it with the other regular courses of study of the school. The boys seemed to like the work, and showed no disposition to withdraw from the class. Although but one hour's instruction per week was given each pupil, a marked improvement in the use of tools was noticed; and it is known that many boys did corresponding work at home for practical and useful purposes, which was furthered at least, if not induced, by the training and suggestions received at the school shop." The late principal of the High School, in his annual report of the first year's instruction in carpentry, said, "It is certain that it did not hinder the general progress of any boy engaged in it, and it is equally certain that the influence of the work was beneficial in various ways in the school."

Superintendent Powell recommended an appropriation of ten thousand dollars for manual training in the Washington schools for the next year, and it is probable that eight thousand will be granted. This will make it possible to increase the number of schools of cookery and of the shops, and to provide additional instruction. Opportunities will thus be provided for all the pupils of the highest two grades of the grammar-schools and of the High School, and probably the number of hours of instruction can be increased from one to two hours a week for each class.

The Yellow-Fever Germ.

Something more than a year ago it was positively announced that a Mexican physician had discovered the yellow-fever germ; that it could be cultivated; and that, by inoculation with it, human beings could be rendered unsusceptible to the disease. Subsequently a similar report was received from Brazil, and together they caused wide-spread discussion both in this country and Europe, not only in the medical journals, but in the popular press. So important was this matter considered in Washington, that the President determined to have a special inquiry made in regard to it, and Dr. George M. Sternberg of Johns Hopkins University, a man of large practical experience with fevers, was appointed to make it. He visited Mexico and Brazil; and, although he has not yet submitted his official report, he obtained permission to prepare and read in advance of it a paper on the subject, setting forth in a general way the results of his inquiry. This paper was read before the College of Physicians, of Philadelphia.

The amount of time accorded Dr. Sternberg not only prevented the investigation from being as thorough as was desirable, but it made it necessary for him to visit Brazil in June, which is in the winter season south of the equator, and Mexico in September, when there were comparatively few cases of yellow-fever. His opportunities for observation, therefore, were not as good as could be wished. But his inquiries did go far enough to justify him in saying that he found really nothing to sustain the sanguine expectations of the Mexican and Brazilian scientists. Such examination as he had been able to make in Havana, Vera Cruz, Rio Janeiro and other Brazilian ports, which had yellow-fever, had not discovered any such micro-organisms as these gentlemen say they have found. These investigations were not confined to the blood alone, but to the alimentary canal and other parts of the digestive organs, and were extended also to the muscles and other tissues.

In order to show the exact degree of success in preventing yellow-fever by inoculation, Dr. Sternberg said that out of 44 inoculated in Rio Janeiro, 22, or 50 per cent, had been seized with the disease; and of these, 9, or 40 per cent, had died. "This is important," observed Dr. Sternberg, "when taken in connection with the usual rate of mortality, which is 30 per cent, as showing, that, so far from being a protection, inoculation increased the effects."

Dr. Sternberg said that in his official report to the government he had laid stress upon the fact that certain experiments which ought to have been carried out were rendered abortive by his having to return to Washington in accordance with his official orders. Under these circumstances, he had thought it best to advise that the investigation be continued by means of autopsies and with the blood taken from the living patient. In accordance with this recommendation, the President had directed him to continue his inquiry. So far as a practical analysis of the blood of the subjects referred to by the Mexican and Brazilian doctors was concerned, he had failed to find any such condition as they had described. At the same time further experiments ought to be made, although he had found no evidence to prove that the Mexican and Brazilian doctors had solved the problem of preventing yellow-fever by their inoculation and microbe theories.

Copper, Lead, and Zinc.

Prof. David T. Day, geologist in charge of the Division of Mining Statistics and Technology, of the United States Geological Survey, has issued a preliminary statement of the production and consumption of copper and of the production of lead and tin in the United States for the year 1887. The production was as follows: —

	1885. Pounds.	1886. Pounds.	1887. Pounds.
Domestic copper	165,875,766	156,735.381	177,420,524
From imported pyrites and ores	5,086,841	4.500,000	3,750,000
Total	170,962,607	161,235.381	181,170,524
	Short Tons.	Short Tons.	Short Tons.
Desilverized lead	107,437	114,829	135,552
Non-argentiferous lead	21,975	20,800	25,148
Total	129,412	135,629	160,700
Spelter	40,688	42,641	50,340

It is very difficult to secure trustworthy statements of stocks of copper in producers' and dealers' hands, and *in transitu*, and therefore Professor Day has adopted the plan of obtaining statements from the consumers of the country of the amount of copper used by each for a series of years. Answers were received from every brass and copper mill and from every brass foundery of any consequence in the country. The consumption of the copper and brass rolling-mills and wire-drawers was, in 1885, 51,110,522 pounds; in 1886, 63,921,217 pounds; and, in 1887, 72,521,287 pounds. The brass-founders used, in 1886, 8,146,866 pounds, which rose to 9,822,731 pounds in 1887, — an increase of 20.5 per cent in one year. Adding the two series of figures, a total consumption is reached of 82,344,018 pounds in 1887, as against 72,068,083 pounds used in 1886 by the same establishments, — an increase of 14 per cent. Professor Day reaches the conclusion, therefore, that the copper-consumption of the United States has been generally overestimated, and that in 1887 it was not much, if any, in excess of 100,000,000 pounds of new copper.

ELECTRICAL SCIENCE.

Intensity and Consumption of Different Sources of Light.

THE following are results of careful measurements, the unit being a standard English candle. The tables are summarized.

Petroleum Lamps.

A number of different lamps were used. The general result was that all the forms had about the same efficiency. The consumption of oil is about 4.5 grams per candle-power per hour.

Gas-Burners.	Candle-Power, Mean.	Cubic Feet per Candle-Power per Hour, Mean.
Ordinary fishtail	17.	.523
Argand	20.5	.410
Auer's incandescent	12.5	.290
Siemens regenerative No. 3	66.	.260
" " No. 1.	172.	.350
Wenham No. 2	40.	230
" No. 4	181.	160

The argand burner is better than the fishtail: the latter uses nine cubic feet per hour instead of five or six, as is usually calculated, although this is largely a matter of local condition. The Auer incandescent lamp uses only half the gas that the fishtail consumes, but the deterioration of the incandescent material must be added. Of the high-candle-power lamps, the Wenham is most economical.

Arc Lamps (Electric).

	Mean Candles.	Mean Candles per Horse-Power.
Piefer	250	900
Piette-Krizik	820	1,090
Seimens	2,200	1.330

Incandescent Lamps.

	Mean Candles.	Mean Candles per Horse-Power.
Edison (old type)	16	122
" (new type)	16	147
Swan (old type)	16	133
" (new type)	16	157
Siemens	16	169
Bernstein	16	157

Magnesium Lamps.

These consist of a small clock-work which gradually unrolls the magnesium ribbon, and advances it through the centre of a reflector at a rate which can be regulated to equal that of consumption. From one to eight ribbons can be used. A ventilator is provided for the escape of the fumes produced by the combustion of the metal.

No. of Ribbons.	Candles.	Consumption per Hour per Ribbon for 100-Candle Power.
1	3,200	11.14 grams.
2	5,880	14.10 "
4	8,000	14.80 "
6	11,300	14.15 "
8	17,000	14.03 "

The price of the ribbon is nearly five dollars a pound, and this will make the price of one hundred candles per hour sixteen cents. This lamp can be improved, and the price of magnesium will probably fall.

A NEW ELECTRIC METER. — Prof. R. Boernstein of Berlin has invented a new form of current-meter for measuring the amount of current used at points of consumption. It consists of a compact electro-dynamometer whose indications are proportional to the intensity of the current, combined with a planimeter for integrating the deflections. The registering-apparatus is attached to a vertical wheel, which turns by the friction of a horizontal wheel driven uniformly by clock-work, which it touches. As the vertical wheel is nearer to or farther from the centre of the horizontal wheel, its velocity of rotation is less or greater, and its position is governed by the deflection of the dynamometer, being nearer the centre for a small, farther for a large, deflection. The apparatus is compact, and is said to measure to one-half of one per cent: it can be used for both direct and alternating currents. In case the necessity of winding the clock-work were an objection, it would be easy to accomplish this by a small motor that would be thrown in circuit when the spring was uncoiled to a certain amount.

THE RADIOGRAPH. — M. Louis Oliver proposes, by an application of Crooke's radiometers, to measure the total amount of light falling upon the vanes, the record having reference both to the time and intensity of the light. As the vanes of the radiometer revolve, they make contact with a wheel, closing an electric circuit. The wheel form of contact is adopted, as it offers very little resistance to the motion of the vanes. The current closes a relay, bringing into action a more powerful current, which moves the needle of a step-by-step apparatus across a scale. If the instrument is constant in its action, and fulfils the expectations of its inventor, it may be useful for photometric purposes, measuring the number of rotations in a given time.

STORAGE-BATTERIES ON THE BRUSSELS TRAMWAYS. — There have been lately reports of the failure of the storage-batteries on the tramway in Brussels that is experimenting with them. It is said that the deterioration of the batteries has been as much as seven cents per car-mile; and at that price they cost more than horses. The company supplying the batteries has come forward with the statement, that, since they delivered the cells, they have never been consulted in any way, and that their directions have not been complied with. It has been pointed out in this journal, that while in many cases storage-batteries will to-day be cheaper than horses, yet this will only be true when they are supplied at moderate cost, and when the facilities and cost of renewal are reduced to a minimum. At the same time, the cost of the batteries in Brussels is more encouraging than otherwise; for, at seven cents per car-mile for depreciation, the cost will be only slightly greater than that of horses, and the increased speed and comfort will more than compensate for this. The total cost for horses may be roughly estimated at ten cents per car-mile for an ordinary car in our Eastern cities. At seven cents for depreciation, the cost of batteries will be something under eleven cents per car-mile. With the advantages electricity offers, even this should throw the balance in its favor; and the calculation is on the most unfavorable data obtainable.

THE EICKEMEYER DYNAMO. — This dynamo differs from the ordinary type in that the field-magnet coils are wound close around the armature, with a heavy shell of iron outside. The object is to concentrate the lines of force where they are most needed, — through the armature, — and to prevent magnetic leakage. It makes a compact machine, which should give considerable output for its weight. The principle of the 'ironclad dynamo,' such as is embodied in Mr. Eickemeyer's invention, has been claimed by a number of inventors. Whether Mr. Eickemeyer was the first to construct such a machine or not, he seems the first one who has made it a practical success.

AN IMPROVED PRONY BRAKE. — In an ordinary Prony brake, in which the work of a machine is absorbed by the friction of its pulley between two clamps fitting over it, and where the power is calculated from the moment of the force tending to turn the clamps, and the revolutions of the pulley, there are many difficulties. The friction between the clamps and the surface of the pulley varies from different causes, — changes in lubrication, change of pressure due to heating, etc., — and the readings are most irregular. M. E. Meylan has described a new form of brake, simple of use and construction, that will measure with considerable accuracy powers from five-horse power upward. The improvement consists in an automatic arrangement by which the pressure between the clamps is adjusted to compensate for irregularities in lubrication, etc. The two clamps are connected by a system of levers, so arranged, that, if there is a tendency for the whole system to revolve in the direction of revolution of the pulley, the pressure between the clamps is decreased; if it begins to move in the other direction, the pressure increases. This seems a great improvement over the ordinary Prony brake, and will be useful in measuring the efficiency of steam-engines, large electric motors, gas-engines, etc. It cannot, however, replace transmission dynamometers for many purposes, and it is probably not so efficient as the best of the latter class; the Tatham dynamometer, for example. It is an instrument that can be cheaply made, and no doubt will be extensively used.

HEALTH MATTERS.

Cholera-Infantum and the Weather.

AT a meeting of the New York Academy of Medicine, held in February, Dr. A. Seibert read a paper on cholera-infantum and the weather. The frequency and fatality of this disease in this latitude during the summer months make this subject one of great interest. Dr. Seibert includes under the name 'cholera-infantum' all cases of acute gastro-intestinal catarrh in children under five years of age. The basis for this paper was an experience of ten years (1878 to 1888) in the children's department of the German dispensary of New York City, during which time 8,036 cases of gastro-intestinal catarrh had been treated. The disease exists all the year round, even in the coldest weather; and the proportionate mortality, one in four, is just the same in cold as in hot weather. This he claims is shown not only by his own statistics, but also by those of the board of health. The largest number of cases, however, occurred during the summer months. Thus, in the ten Julys there were 2,443 cases, and in the ten Augusts 1,524 cases, while in the ten Februarys there were only 117 cases. The number of deaths was always much greater in July than in August. Thus, during the ten years, the number of deaths reported in the city of New York in the month of July was 12,428, and in August only 6,205. In July, 1881, when the mean temperature was 80°, the number of cases treated in the dispensary was 290; in August of the same year, when the mean temperature was 82°, the number of cases was 223; and in September, when the mean temperature was 87°, the number of cases was 137. During the summer months it was found that the number of cases and of deaths bore no relation whatever to the rise and fall of temperature, and the same was true as regards the range of humidity; so that warm, moist weather did not predispose more to the disease than warm, dry weather. No relation could be demonstrated between the prevalence of the disease and the rainfall, and the same was true in regard to the velocity of the air-current. According to prevalent opinion, the months containing the greatest number of hot days ought to have had the greatest number of cases and of deaths; but there was no evidence supporting this. It is evident, Dr. Seibert thinks, from the facts, that *hot* weather is not necessary for the production of the disease, but that *warm* weather is. Statistics show that in the early part of the summer season, as soon as the minimum daily temperature remains above 60° for a number of days (a week or more), the disease becomes epidemic; and this, no matter how high above 60° the temperature may go, whether it is 75°, 80°, or 85°. His conclusions are as follows: First, Hot weather, either dry or moist, is not necessary for the epidemic appearance of acute gastro-intestinal catarrh; Second, Warm weather, either dry or moist, showing a minimum daily temperature of not less than 60°, brings on the epidemic every year, irrespective of the height of the maximum daily temperature; Third, The disease loses its epidemic character as soon as the minimum daily temperature falls below 60°, as in October; Fourth, Therefore this disease cannot be brought about by the direct effect of high temperature upon the child's body.

Dr. Seibert then went on to say that the lowest temperature of each day was reached during the night; and it was at this time that the milk which furnished the principal food of so many young children was brought into the city. It was often carried long distances, being much jolted about, and absorbing impurities from the time it left the cow: it was therefore only a question how far the decomposition of the milk had advanced by the time it reached the child. It was well known that a low temperature retarded decomposition; and Dr. Cyrus Edson, of the New York Health Department, had informed him that in his experience he had found that milk usually began to turn whenever its temperature reached 60° or higher. Chief-Engineer Birdsall, of the Department of Public Works, had also informed him, that, whenever the temperature of Croton Lake rose to 60° or above, there was a peculiar taste about the water, which he attributed to the decomposition of certain matters contained within it.

As to the point why there are always so many more cases and deaths in July than in August, the difference usually amounting to at least one-third, it seemed to him that it might perhaps be explained by the fact that it took a few weeks after the onset of warm weather to fully arouse the tenement-house population to the danger to which their children were exposed from this disease, and to the necessity of taking suitable precautions as regards fresh air and diet for its prevention.

In the discussion which followed the reading of the paper, Dr. L. Emmett Holt referred to some statistics of Liverpool which tended to confirm some of Dr. Seibert's conclusions. In one year 347 deaths occurred from cholera-infantum in July, the average temperature being 58.9° F., while in August, when the temperature was 59.2°F., there were 969 deaths. Dr. Holt said that in summer there were different forms of diarrhœal disease in growing children, and that he thought it was advisable that some distinction should be made between them. In the production of what is ordinarily known as 'summer-complaint,' he believed that there were four principal factors concerned, — namely, heat, feeding, sanitary conditions, and constitution, — and that the most important of these features was heat.

Dr. J. Lewis Smith thought that there was perhaps a fallacy in comparing summer diarrhœa with that of winter; the two being, in his opinion, very different diseases. He believed that summer-complaint was due to heat, but just how this acted was not yet known. Heat alone is not sufficient, else the disease would be prevalent in the country as well as in the city. How much gaseous exhalation had to do with its production was not ascertained. The opinion is gaining ground that summer diarrhœa is a microbic disease. It was well known that milk which had begun to decompose had a tendency to give rise to the affection. In Asiatic cholera the causative agency of Koch's bacillus had been pretty generally accepted, and it was believed that this microbe was received into the mouth, and acted as a source of irritation to the intestines by its actual presence, and not by causing decomposition of food. In like manner it did not seem unreasonable to suppose that micro-organisms might act in the same way in some cases of summer diarrhœa.

Dr. A. Caille thought that decomposing milk was the chief exciting cause, while a high temperature paves the way. Two French physiologists had made some experiments by exposing animals to a continual temperature of 104°, and the phenomena which they observed to result from the exposure were: (1) increase of nervous excitability; (2) nervous depression; and (3) convulsions, coma, and death; death resulting more speedily in a moist high temperature than in a dry high temperature. The same results had been noticed to be produced in children when the weather was very hot. It was his opinion, therefore, that while high temperature did not directly produce diarrhœa, it did have a pernicious effect upon the system, and under these circumstances any irritating substance would be likely to give rise to diarrhœa.

As regards the smaller number of cases of summer-complaint, as well as of deaths from the disease, in August than in July, he thought that perhaps one reason for this was that a much larger number of children left the city in August than in July, while those which remained had the advantage of the numerous fresh-air excursions then provided for the poor.

Dr. A. Jacobi said that the cases which occurred were not all alike. In some there was a simple catarrh, in others a tendency to collapse. He thought that great heat would kill by its direct effect on the heart, the myosin of the muscular tissue of that organ being coagulated by the heat. Intense heat would cause a dilatation of the blood-vessels of the surface of the body, and deficient nutrition of the brain would result, and collapse. These were the fatal cases among both the rich and the poor.

WASTED SUNBEAMS; UNUSED HOUSETOPS. — In a recent number of the *New York Medical Record*, Dr. Gouverneur M. Smith makes some extremely valuable suggestions in an article entitled 'Wasted Sunbeams; Unused Housetops.' He says that human habitations, though erected for the benign purposes of insuring comfort, affording protection, and promoting family privacy, are, unfortunately, often the causes of a number of the morbid ills from which mankind suffers. This fact is true, as relating to the residences both of the rich and of the poor. It is a difficult task to construct an absolutely sanitary dwelling. In nearly every house, however, there are more or less avoidable insalutary conditions, which are undermining the health of each family circle. After describing the advantages of tent-life, and the benefits which accrued to those who lived most of the time out of doors, he goes on to speak of the incompatibility of such a life with the demands of a civilized race, and a rigorous climate. History tells us that certain nomadic tribes in the early ages, finding aggregation and permanency of residence desirable for business and other purposes, built solid structures, and, striking their tents, henceforth dwelt in substantial residences. While the early Orientals had but little knowledge of the exact nature of air and sunlight, they nevertheless believed that fresh air was an important factor in maintaining physical vigor, and that exposure to the solar beams was salutary. In constructing their homes, their architects utilized their housetops, and gave them salubrious plateaus. The roofs, gently declining as watersheds, were covered either with tiles, bricks, or cement, makthem as durable as pavements. Beddings of turf, prettily distributed, made these artificial deserts to 'blossom as the rose.' Dr. Smith asks the question, "Is there any thing, either in our climate or state of civilization, which prevents us from, in a measure, imitating such ancient, useful, and fashionable airiness?" Our atmosphere is proverbially bright, and many of the severer days are sunshiny. In a great metropolis like New York there are thousands of children and invalids, to say nothing of those in mature years and engaged in the ordinary pursuits of life, who require more fresh air and sunning than is now practicable. City yards are small, shut in by tall buildings and high fences; the parks may not be adjacent; and the streets afford ill-conditioned pleasure-grounds. He suggests that it would be no difficult task for architectural ingenuity, assisted by sanitary science, to contrive some method of using the thousands of acres of housetops so that roofs, now so useful in affording indoor protection from cold, sleet, and rain, can be made additionally useful at certain seasons by affording out-door recreation and protection for invalidism. The 'solarium' of the New York Hospital, made attractive with its plants, birds, and aquaria, is a potent ally of therapeutics in restoring the convalescents, and at the Hospital for the Relief of the Ruptured and Crippled the contagious sparkle of the sunbeam is found shining in the eyes and lives of the young patients.

BOOK-REVIEWS.

Exact Phonography. By GEORGE R. BISHOP. New York, The Author (At the New York Stock Exchange). 12°. $2.

EVERY writer of shorthand has often had occasion to regret the imperfections of the best of the modern systems. Pitman's 'Phonography,' with the American modification of it, and one or two others, English and American, which are in the main attempted improvements upon it, are almost perfect as to the representation of the consonant sounds and their combinations, and, if one attempts nothing more than the 'corresponding style,' are quite as unambiguous and legible as fairly written longhand script. But while the 'corresponding style' may be written much more rapidly than longhand, it is impossible to attain sufficient speed in it to make it available for the uses of the reporter, or of the student, professional, or business man, who desires to use it for jotting down quickly notes of what he sees or hears. To adapt it to these practical ends, it has been found necessary in all the older systems to abbreviate, sometimes at the expense of exactness and legibility. Vowels have been almost entirely omitted, and indicated by the position with reference to the line of the ruled paper upon which the consonants are written; and as only three positions are used, while there are nearly twenty different vowel-sounds, it follows that the same character in the same position frequently represents three or four different words (in a few cases from six to a dozen). The context alone can show which of these words was intended, and the success of the writer in determining this at any future time will depend largely upon his knowledge of the subject treated of, or upon the tenacity of his memory. The prevailing systems of shorthand, also, fail when a great number of technical terms or foreign words or phrases are introduced, unless the terms, words, or phrases are those with which the reporter is familiar, and for which he has invented special contracted forms. Mr. Bishop, who is the stenographer of the New York Stock Exchange, has undertaken the difficult task of devising a system of shorthand in which, without sacrificing brevity and speed, all essential vowel-sounds shall be actually represented by written signs. His purpose is to leave little or nothing to the judgment or memory of the writer in transcribing. It is impossible, without making a practical trial of Mr. Bishop's 'Exact Phonography,' to determine to what extent he has succeeded. His system is certainly exact and unambiguous, and therefore easily legible, even in its most contracted forms; and it looks as though it might be written with as great speed as any of the older systems. Mr. Bishop calls his book 'A Text-Book for Self- and Class-Instruction.' It is certain that no previous new system of shorthand has been introduced to the public with so much fulness of explanation and wealth of illustration as 'Exact Phonography.' Every thing is made perfectly plain for the attentive student.

European Schools of History and Politics. By ANDREW D. WHITE. Baltimore, Murray. 8°.

IN *Science*, No. 253, we noticed the two interesting papers by Dr. H. B. Adams and Professor Fredericq on historical teaching in the United States and in England and Scotland. The present paper, by ex-President White, supplements these. It is the last issue for the year 1887 in the Johns Hopkins Series of Studies in Historical and Political Science. Most of Mr. White's accounts are based on his personal observation, and gain thereby much in value. On p. 11 we read, "As to the general character of all this instruction among German-speaking peoples, whatever it may have been in the past, it is not at present calculated to breed *doctrinaires*; it is large and free; the experience of the whole world is laid under contribution for the building-up of its students; questions of living interest have their full share in the classrooms. To know how our own democracy is solving its problems, one of the German universities sends to this country for study one of its most gifted professors, — one from whom thinking men on this side of the Atlantic have been glad to learn the constitutional history of their own country. The lectures of Professor von Holst, as delivered here, and his work upon the constitutional history of the United States, are sufficient to show that this instruction in the German universities is given in a large way, and is not made a means of fettering thought. At no seats of learning in the world, probably, is political thought more free. The University of Berlin stands in the main avenue of the capital of the German monarchy directly opposite the imperial palace. Within a stone's throw of the Emperor's work-table are the lecture-desks of a number of professors, who have never hesitated to express their views fully upon all the questions arising between democratic and monarchical systems. I have myself, in these lecture-rooms, heard sentiments freely uttered which accorded perfectly with the ideas of Republican and Democratic American statesmen." In a similar way the historical and political teaching in France is favorably commented on. The most valuable portion of the paper is that in which the writer applies the experience of Europe to ourselves, and points out what we should be doing in this direction, and how we may do it. It is an eloquent and able plea for broader and better historical and political teaching in our own colleges and universities. As an appendix to the main paper, there are printed 'Modern History at Oxford,' by W. J. Ashley; 'Recent Impressions of the École Libre,' by T. K. Worthington; and 'Preparation for the Civil Service in the German States,' by L. Katzenstein.

Practical Geography for Schools. By ALFRED HUGHES. Oxford, Clarendon Pr. 12°. (New York, Macmillan, 60 cents.)

THE present volume, which is the first part of a geography for schools, has for its object, not the explanation of geographical phenomena, for such is not given in any instance. The data of geography are considered as given and as explained, and they are used for the purposes of teaching geometrical drawing, arithmetic, and the elementary ideas of geometry. By this method the author hopes to impress the data of ordinary descriptive geography, by constant use, upon the mind of the pupil. The book deals only with mathematical geography, and many examples are given for computing distances between two places, differences of time, altitudes of the sun and of stars. As for these purposes the latitudes and longitudes of places must be known, the pupil will acquire by practice a considerable amount of knowledge in this line. But, although this may be true, we cannot recommend the author's methods. We assume that the book is not intended for teaching geography, as it does not try to prove any of the facts that are mentioned in it. The geographical problems of mathematical geography are far too difficult for boys. The author recognizes this fact, and claims as an advantage for his methods, that little or no mathematical knowledge is necessary before children can master all the methods explained in his work. But this advantage is reached only by an extreme laxity of definitions, and by applying wrong geometrical proofs: therefore the pupil will have to unlearn at a later stage the greater part of what has been taught to him according to the plan of the book. Here is an example. One of the very first chapters of the book teaches how to draw lines of latitude and longitude suitable for a map of any part of the earth's surface. First it is said, without an attempt at explanation, that it is impossible on a flat piece of paper to draw correctly lines that themselves exist on the round surface of the earth. Then a rough approximation to a rectangular projection in which the real length of the parallels is preserved, is described as the only method of projecting maps, without any further explanation than that the parallels and the central meridian have their real lengths; while it is not shown that the meridians and angles are greatly distorted. In computing distances, the author assumes, adding a brief remark that it is not quite correct, that the distance along the parallel of latitude is the distance between two places. All through the book this looseness prevails. If we agree that the teaching of geometry should train the faculty of logical reasoning, we must object to the methods advocated in this book. From the standpoint of the geographer, there is nothing in it that might not be attained just as satisfactorily by other methods which discard these unnecessary mathematical considerations, that are beyond the grasp of children of that age for which the book is intended.

A Laboratory Manual of Chemistry. By OSCAR OLDBERG and JOHN H. LONG. Chicago, W. T. Keener. 8°. $3.50.

THIS manual is intended for students of pharmacy and medicine, and presents a well-chosen course of experiments, the object of which is to give acquaintance with the properties of the more common elements, and to show the syntheses of the more important chemical compounds and pharmaceutical preparations. A short course in qualitative analysis, special examples of quantitative methods, modes of assay of a few important drugs (notably the alkaloids), and a sketch of the chemical and microscopical examination of urine, constitute important features of the work. In the directions for compounding, quantities are usually expressed in proportionate parts, but occasionally absolute weights and measures are employed. When such is the case, it is a pleasure to note that it is the metric system of which use is made. The pharmaceutical and chemical names appear side by side.

The work is well arranged, and admirably adapted to the use of the class of students for whom it is especially intended.

Skeleton Notes upon Inorganic Chemistry. Part I. Non-Metallic Elements. By P. DE P. RICKETTS and S. H. RUSSELL. New York, Wiley. 8°. $1.50.

IN the words of the authors, "It is not intended that this work shall take the place of a text-book, and the authors claim no originality beyond the general arrangement. Much matter has been purposely omitted for the student to supply in his own way. It is believed that by employing these 'Skeleton Notes' as a framework upon which to build, the beginner will be aided in following lectures, and learn to study chemistry in a systematic manner."

The plan of placing in the hands of students an outline of lecture-notes in order that attention may be given more fully to the general argument and demonstrations of the lecturer, presents many advantages, and has not wanted recognition these many years. That such a scheme may be useful to the fullest extent, it would seem to be the case that the order of topics in the notes should follow the order of discussion in the lecture, and that this should be a rational one. In this skeleton the chemical elements are taken up in the alphabetical sequence of the initial letters of their names, — an arrangement which certainly is not suggestive of existing relationships, nor likely to aid in the realization of the hope that the beginner may "learn to study chemistry in a systematic manner." The notes under individual heads are brief and orderly, in general, though occasionally inexact.

The value of such a book must depend, as a matter of course, upon the use made of it by lecturer and student.

Weather: a Popular Exposition of the Nature of Weather-Changes from Day to Day. By Hon. RALPH ABERCROMBY. New York, Appleton.

THIS volume considers only the practical questions involved, and is an excellent popular work, easily understood, and maintaining great interest in its perusal.

The first three chapters are elementary, and treat of weather prognostics which may be made from 'clouds,' 'audibility,' 'visibility,' 'whirling dust,' etc., without the aid of instruments. In the advanced portion our author takes up the question of weather-maps (Chapter IV.); meteograms, or records of single instruments at a station (V.); squalls, thunder-storms, and non-isobaric rain (VIII.); whirlwinds and tornadoes (IX.); diurnal variation of weather (XI.); types and spells of weather (XIII.); weather-forecasts (XIV. and XV.). These chapters are especially interesting, and deal with their subjects in a lucid and comprehensive manner.

Our author has taken advanced ground on many questions, and does not fear to admit our want of a good explanation of phenomena. No less than twenty-nine times does he profess this, and in almost all these cases there have been theoretical explanations given by others. An important principle is enunciated at p. 50, — "diurnal changes modify but do not alter intrinsic quality of weather,"— and this view is maintained in many places with great force and good proof. Our author, while cutting loose from many erroneous views, yet clings to some to which we must take serious exception. On p. 117 we are told that the clouds indicate great cold in front of storms; yet at p. 139 the usual view is given, that, owing to heat, the pressure in the upper layers is augmented near a cyclone; and this latter view is again stated on p. 232. As a matter of fact, later researches have shown that this hypothetical rise in pressure is almost nothing. If we take barometer readings at Mount Washington, for example, during the passage of a cyclone, and reduce them to sea-level, we shall find the fall in pressure at the base only .04″ or .05″ less than at the summit.

On p. 126 we read, "To this ascensional movement (in cyclones) undoubtedly must be attributed the rain and cloud which we find there, — rain near the centre, where the ascensional impulse is strongest; cloud round the outside, where the uptake is less strong." And yet repeatedly our author refers to "non-isobaric rain," or rain remote from just this hypothetical uptake. There is hardly a worse fallacy in meteorology; and, moreover, no valid proof has ever been advanced of this uptake. There has been a rather good reason for the endurance of this theory in Europe, for there, in the temperate regions, rain falls largely near a cyclone-centre; in this country, however, most of the rain is far in advance of the storm-centre. Probably ninety per cent of our rain may be fairly considered 'non-isobaric.' On p. 221, Tyndall's theory that water-vapor absorbs the quality of heat radiated from the ground is accepted; and yet it is quite well known and received to-day, that this was refuted by Magnus, who showed that it was only the condensed vapor in the shape of water-droplets, and not the vapor, that produced the effect. On p. 253 the theory is accepted that there is a most violent rush of air from under rain-drops in a squall. Computation has shown that this cause for the observed wind is purely imaginary, and the air-motion caused by the heaviest possible rainfall is entirely inappreciable. In seeking for an explanation of changes of pressure-distribution, our author, at p. 389, suggests as a cause, "the general circulation of the atmosphere from the hot equator to the cold poles." This statement is hardly borne out by the observations of air-currents.

On the whole, the book is a most admirable and practical exposition of weather-changes, and will repay careful perusal by all interested in the weather and the progress of meteorology.

A Study of the Histological Characters of the Periosteum and Peridental Membrane. By G. V. BLACK. Chicago, W. T. Keener. 8°.

THE contents of this volume appeared in serial form in the *Dental Review*. They include a thorough study of the peridental membrane and its tissue elements, and also of the periosteum, which is so closely related to it. Very little has been written on the subject of the peridental membrane, and until recently there has been very little interest in the subject among dental specialists. Within a short time, however, attention has been directed toward this membrane and its structure, and a great and wide-spread interest has been awakened. There are several reasons for this, among which the following may be mentioned: there is a greater and a more general interest felt now than ever before in the correction of irregularities of the teeth, in which changes in this membrane, and the relation of the parts which it unites, are brought about; and then, too, there is a greater interest manifested by the masses of the dental profession in the retention of pulpless teeth, and roots which have lost their crowns, and which are dependent upon the continued health of the peridental membrane under modified conditions. Another reason which the author advances for the renewed interest in the subject is the revival, under varied forms, of the ancient methods of replanting and transplanting teeth, the success of which is supposed to be dependent, in whole or in part, upon the reconstruction of the peridental membrane, in its re-attachment to the teeth. Dr. Black has made a thorough, and, as it seems to us, an exhaustive study of the subject from an histological standpoint. The illustrations, of which there are sixty-seven, are admirably drawn, and reproduced in a most satisfactory manner. For dentists and those who desire the latest researches into the histology of the periosteum and peridental membrane, this book is invaluable.

The Mind of the Child. Part I. The Senses and the Will. By W. PREYER. Tr. by H. W. Brown. (International Educational Series, Vol. VII.). New York, Appleton. 12°. $1.50.

DR. HARRIS is performing a useful service in the editing of the series of which this work is a volume, and nowhere more so than in the publication of this issue. The work itself is well known, and it will be sufficient to say that it is the very careful and detailed record of the development of Professor Preyer's own child, corroborated by observations from the literature of the topic. The growth of the powers of the senses are studied, and the results controlled by experimental methods. The gradual control of the muscles as the organ of the will is no less carefully pictured, and the work has long been recognized as the most complete contribution to the growing science of 'infant psychology.' The American edition is presented under the most favorable auspices. It is prefaced by an introduction from the pen of Professor Stanley Hall, in which he points out the great educational significance of the work, and demonstrates the practicability of this kind of work in the normal school by a reference to the system in vogue in the Worcester school, of which Mr. E. H. Russel is the principal. Here part of the course in psychology consists in gathering observations of child-life under various rubrics, and studying from this material the psychology of the child-mind. Not only is a valuable material thus gained, but the students are taught to see the meaning of what they are apt to let pass unnoticed, and to enter more intelligently and sympathetically into the thought-habits of the young pupil. The system has been an entire success, many of the normal-school graduates taking such original observations of children as the bases of their graduating theses. The work is creditably translated from the second German edition, and is a very essential contribution to the further spread of useful educational ideas. This is only the first part of Professor Preyer's work. The translation of the second part will soon be ready, and will be anxiously waited for.

Der Tierische Magnetismus (Hypnotismus) und seine Genese. Von JOH. G. SALLIS. Leipzig, 1887. 8°.

De la Suggestion et de ses Applications à la Pedagogie. Par Dr. EDGAR BÉRILLON. Paris, 1888. 8°.

THESE pamphlets are but samples illustrative of the wide-spread interest in the study of hypnotism, that forms so notable a feature of the scientific activity of France, and, to a far less extent, of other European countries. The first of these essays is devoted largely to the historical aspects of the subject; and, in addition to the usual account of Mesmer and his successors, the author brings into connection with hypnotism many of the pseudo-sciences of former centuries, and thus surrounds the history of mesmerism with a suggestive philosophical interpretation. A second leading point in the essay is in the form of a warning as to the dangers of hypnotism, urging that it is a purely technical acquisition, to be used only by experts, and that, above all, is it unsuited for public exhibition by money-making adventurers. The practices of the latter should everywhere (as they have been in many European countries) be forbidden by law. This feeling that Dr. Sallis so forcibly expresses is gaining wider and wider sympathy; and it seems necessary, for the maintenance of the good name that this young science has with difficulty acquired, that it should be placed entirely in the hands of reliable scientists.

Dr. Bérillon's essay contains what at first sight is an alarming proposition: it is nothing less than 'hypnotic moralization.' Unruly, vicious, or lazy children are to be put into the hypnotic condition, and then to have impressed upon them the reformation of their faults. In support of the good that can be thus accomplished, cases are cited in which bad habits of a very perverse type were cured, children backward and sluggish were aroused to a more normal activity, and the benefits thus brought about were shown to be quite permanent. Such a proposition naturally and properly arouses an objection, not only because such an interference with the normal development of the child seems unwarranted, but because we do not as yet know enough of the after-effects of hypnotization to make such an application of what must be a semi-morbid state justifiable. On the other hand, it must be remembered that Dr. Bérillon recommends this treatment only for cases in which ordinary educational means fail, and that it is only to be practised with the consent of the parents and by a skilled physician. He reminds us, too, that many of our reformatory methods interfere with the child's moral freedom, and are equally artificial. We have simply become accustomed to them. He claims, that, if carefully applied, the danger of harmful results is practically *nil*, and has succeeded in gaining the indorsement of several prominent physicians and educators to his plan. It is of course wrong to measure the utility of a project by its liability to abuse; but the abuse is an important factor, and it is at least an open question whether the varied abuses to which the practice here proposed is evidently open does not seriously interfere with its general adoption. The author has at least succeeded in convincing many capable of forming an opinion, that his project is worth a serious consideration.

NOTES AND NEWS.

THE sixteenth annual meeting of the American Public Health Association will be held at Milwaukee, Wis., Nov. 20–23, 1888. The executive committee have selected the following topics for consideration at the meeting: the pollution of water-supplies; the disposal of refuse matter of cities; animal diseases dangerous to man; maritime quarantine, and regulations for the control of contagious and infectious diseases, and their mutual relations. The topics given indicate the subjects which it is desired to consider, yet they are not to be regarded as the exclusive topics of the meeting. Mr. Henry Lomb of Rochester, N.Y., now well known as the originator of the 'Lomb Prize Essays,' offers, through the association, two prizes for the current year, on the following subject: 'Practical Sanitary and

Economic Cooking adapted to Persons of Moderate and Small Means;' first prize to be $500; second prize, $200. All essays written for the above prizes must be in the hands of the secretary, Dr. Irving A. Watson, Concord, N.H., on or before Oct. 15, 1888.

— Dr. William Noyes contributes to the *Journal of Social Science* (No. xxiv.) a convenient summary of the modern view of the criminal type. Taking Lombroso as his guide, he shows in how very many respects the criminal presents abnormal differences, both physical and psychic, from his fellow-men. These differences are to a large extent indicative of a reversal to a more primitive, savage type. It is hopeful to add, that many of the peculiarities can be detected in children, and that the evil results which they forebode can be to a large extent prevented by a properly directed education.

— At the March meeting of the Society of Medical Jurisprudence and State Medicine of New York the best method of executing criminals was discussed. Dr. William A. Hammond advocated strangulation by a silk or cotton rope as the most satisfactory method at command. He criticised the recent report of the State Commission, which recommended the use of electricity, and said that the objections raised against the present method of execution would apply with equal force to any form of execution. Several of the members took exception to Dr. Hammond's statement that strangulation was painless, and Drs. Spitzka and Brill spoke in favor of the guillotine. The society finally adopted, by a nearly unanimous vote, a resolution condemning the bill now before the Legislature, which embodies the recommendations of the State Commission referred to, an abstract of which has already been given in *Science*.

LETTERS TO THE EDITOR.

**** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

Twenty copies of the number containing his communication will be furnished free to any correspondent on request.

The editor will be glad to publish any queries consonant with the character of the journal.

Experiments in Vision Again.

SOME time since in *Science* (No. 262) we referred to an experiment which we thought indicated an interesting connection between monocular and binocular vision. We have another to present here which seems in our own experience to possess a similar importance. It is perhaps even more forcible than the first, and may be worth the attention of those interested in visual phenomena.

Take two circles as represented in Fig. 1, and either bend the sheet of paper in the median plane, so that the circles can be made to appear in inclined planes at any desirable angle, or cut the paper so that they may be held at a suitable inclination to each other in planes that will intersect at any given point. The larger the circles, the better will be the effect, the more clearly marked will be the results we have to describe. Now, if we incline the planes of the circles several degrees, it is well known that the retinal impression becomes ovular or elliptical; and the circles also will appear more or less so, when we make allowance for the judgments of experience which can recognize a real circle, although the impression is not identical with it in form. If, then, we combine the circles by convergence at this slight inclination, the central and fused image will retain its slightly elliptical form, although the surface upon which it appears seems a plane vertical to the median plane. The real inclination of the two surfaces does not appear to determine any irregularities in the effect; but binocular agencies, perhaps, balance the two opposing influences from monocular vision so as to present the appearance of a plane. But if we increase the inclination of the two circles and their planes, say each of them to 45° from the horizontal meridian, and cutting the median plane so as to form a right angle with each other, and then combine them by convergence, the effect may be entirely changed. We find that rivalry may take place between the monocular images, and that there is a tendency to see only one of the images at a time, of those belonging to corresponding points. Not only does the circle appear elliptical, but its plane appears in its real inclination to the median plane; that is, the circle seems to lie in the third dimension, with one side nearer the observer than the other, precisely as it ought to appear in case that vision presents the real relations in space of its objects. This effect may alternate from one inclination to the other, showing that there is rivalry between the monocular images for expression in the field of vision. Fatigue may cause this alternation. But the interesting fact to be noted is, that binocular influences no longer avail to make the plane of the fused images lie in plane of the horizontal meridian. The circle seems inclined to this, and is seen in its real space relations, corresponding exactly to the innervation for the individual eye which sees it. If we may ever speak of monocular influences suppressing those of binocular action, we may do so in such cases as these.

We have been able also to obtain more complicated results of the same general kind. This we accomplished by the use of stereoscopic figures, as in Fig. 2. The experiment is performed as before.

FIG. 1.

If placed at the proper inclination, and combined by convergence, we may notice the inclination of both circles; that is, the monocular images of one concentric set. The same alternation can be observed as before. But by careful practice we have been able to notice the larger circle inclined in one way to the median plane, and the smaller in the opposite way. This makes the planes of the larger and smaller circles of the apparently fused image appear to cut each other at an angle instead of lying in the same plane. This can be explained by supposing that the monocular image of one circle is seen by the right eye, and the monocular image of the other by the left eye. And as each appears to be in the plane in which it really exists, the two must appear to cut each other at an angle. Various alternations may be observed, besides those mentioned in Fig. 1; but they are due merely to the larger number of circles and the different possible relations represented. The results are especially interesting as calling attention to and illustrating the fact that *binocular* disparate points in their visual activity functionate precisely as *monocular* disparate points. This is simply another way of expressing the phenomena of rivalry; for we observe in these, that one area of the right eye may be acting in one way while the corresponding area of the left is inactive, and a disparate area of the left may be acting in another way while the corresponding area in the right is inactive: hence the functional activity of one eye in regard to the larger circle will not prevent the action of the other eye in regard to the smaller circle of Fig. 2. In this case the suppression of one of the binocular images in each case would leave the visual process entirely to monocular functions; and hence, when the inclination of the real planes is great enough to be noticed, it is quite possible that the effect would represent the two circles in different planes cutting each other. It has required much practice, however, to get the results we have described, as the easier tendency, when any inclination of the circles is observed at all, is to per-

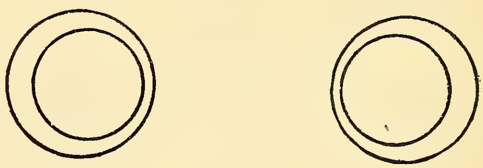


FIG. 2.

ceive them both in the same plane, representing the experiment of Fig. 1, only with a greater number of circles. It is quite possible that very many experimenters cannot obtain the effect at all. In our own case we are much aided by the readiness with which the innervation of each eye can be carried on independently of the other. In fact, the phenomenon may be peculiar to our own experience alone, and may not be capable of verification by others. We shall be glad to know if it can be verified. J. H. HYSLOP.

Baltimore, Md., April 26.

Is the Rainfall increasing on the Plains?

I NOTICE a letter from Mr. Curtis in *Science* of April 20, calling attention to an error in the accepted Fort Leavenworth precipitation, due to the reckoning of snow (unmelted) as rain. I have looked up Schott's original manuscript, and find the large precipitation in January, 1871, entered "11.25″?" showing that the compiler was aware of a possible error. A careful examination of the original record shows that the true value is 1.20 for January, and 46.70 for the year. For 1872 the amount should be 51.65. I am inclined to think that Mr. Curtis is altogether too sweeping in his criticism. The probability of such an error having crept into the bulk of the Fort Leavenworth records is exceedingly small; and, moreover, the records nearly all the way through are partially checked by parallel records at neighboring stations.

It is certainly true, that, "if such errors as these exist in the records, it is surprising to find that the rainfall of Kansas is increasing." In this quotation from the letter, I have omitted a 'not' before 'surprising.' The reason is plain. Since 1873 the Fort Leavenworth records are not quoted, but only those of the Signal Service. Now, it is recognized that the exposure of the latter gauge will give too little rainfall; and, moreover, the measurement of melted snow is invariably too small. Both of these causes combine to render the records too small since 1873; and, if we assume that before then the records averaged five to ten inches too great, it is easy to see that there has been an enormous increase in rainfall, if the last fifteen years average more than the previous fifteen.

I wish to call attention to an exceedingly interesting point in this connection. During the last four years, Dr. Carpenter, at West Leavenworth, has reported from five to twenty-five inches more rain each year than the Signal Service two miles due east. Will not some scientist residing near Leavenworth take a special interest, and determine the possibility of such a large increase in precipitation in so short a distance? This will also have a most important bearing on the rainfall question. H. A. HAZEN.

Washington, D C., April 21.

Chloride of Nitrogen.

IT seems to me worth while to call attention to the fact that the preparation of chloride of nitrogen by the electrolysis of a solution of ammonium chloride, announced in your last issue (p. 206) as a new discovery, has, as a matter of fact, long been known. This method of preparation forms, indeed, one of the stock lecture-experiments in many courses in chemistry. Incidentally it may be noted that within the last few weeks chloride of nitrogen has been made in considerable quantity in Göttingen by Dr. L. Gattermann, who has also for the first time made careful analyses of the substance. The difficulty involved in such an investigation will be appreciated to some extent when it is borne in mind that chloride of nitrogen is probably the most explosive chemical compound known. Dr. Gattermann's investigation has been spoken of in German newspapers as an act of heroism. IRA REMSEN.

Baltimore, April 28.

Christmas Customs in Newfoundland.

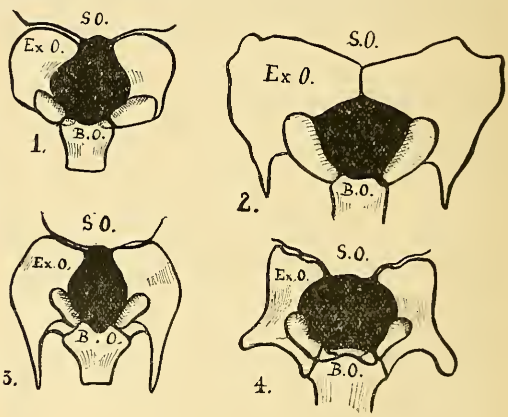
IN *Science* for Feb. 24, 1888, it is said, in the note on 'Christmas Customs in Newfoundland,' that the practice there described of tying a wren to a bush, and singing the rhymes there given, is not known in other places. It may interest your readers to know that fifteen years ago certainly, and probably at the present time, the country boys in County Clare and County Limerick, Ireland, if not in other counties, never let St. Stephen's Day pass without bringing round from house to house a bush adorned with ribbons, with on the top a struggling wren, or, if not a wren, some small bird for that day dignified by the name. The rhymes sung during the cruel ceremony were, I think, identical with those given in your paper. And in some way or other the coppers which the youths pocketed — given them at the houses they visited, whether on condition of releasing the wren or not — were supposed to do honor to the dying bird. W. F. STOCKLEY.

Fredericton, Canada, April 19.

Osteological Notes.

IT is often extremely difficult to determine with accuracy the boundaries of the four centres of ossification which characterize the occipital segment of the cranium in the various orders of the mammalia. The tendency to early co-ossification of these separate centres or bones, as they are generally described by anatomists, is for the most part so great, that it is impossible to obtain the information desired without the aid afforded by the collections of large museums; and, even with this advantage, perfect accuracy of description is scarcely possible in many cases, on account of the lack of material.

As a general rule, with notable exceptions, however, the four bones — viz., the supra-occipital, two ex-occipitals, and basi-occipital — individually contribute, in a greater or less degree, to the formation of the *foramen magnum*, the amount thus contributed by each depending very much upon the shape assumed by that opening (compare Figs. 1 and 4).



In both the odd-hoofed and pair-hoofed animals (*Ungulata*), in the elephants (*Proboscidia*), dugong and manatee (*Sirenia*), in the pangolins (*Edentata*), and in the opossum (*Marsupialia*), the ex-occipitals meet above, and thus shut out entirely the supra-occipital from participation in the margin of the foramen (Fig. 2).

In the remaining orders it may be said that the supra-occipital contributes from a third to a fourth of the border of the great opening, the lines of suture between this bone and the ex-occipitals running slightly upward and outward to a point corresponding with the level of the zygomatic process of the squamosal.

The ex-occipitals, with few exceptions, as in the dog (*Carnivora*) and in the armadillos (*Edentata*), supply the greater portion of the condyloid surface, the remainder being furnished by the basi-occipital.

The lines of suture which mark the separation of these two segments should be drawn from the margin of the *foramen magnum* downwards and outwards, bisecting the inner third of the condyle, to a point corresponding with the centre of the tympanic or auditory bulla (Fig. 4). In the cases where the condyles are the product of the ex-occipitals alone, as in the dog, the lines of separation must be drawn in the same general direction, but not so as to include any of the condyloid surface (Fig. 3). D. D. SLADE.

Museum of Comparative Zoölogy, Cambridge, Mass., March 30.

BOOK-NOTES.

— D. C. Heath & Co. have in press, to be ready in May, a book of 'Chemical Problems' by Drs. Grabfield and Burns of the Massachusetts Institute of Technology.

— Messrs. E. & F. N. Spon inform their friends and customers that they have removed to No. 12 Cortlandt Street, a few doors from Broadway.

— Vol. I. is now ready of the new edition of Watts's 'Dictionary of Chemistry.' It has been revised and entirely re-written by H. F. Morley and M. M. Pattison Muir, assisted by eminent contributors.

— In the *Andover Review* for May, Mr. Williston Walker of Leipzig, Germany, under the title of 'Notes from a German University,' supplies many details of student-life which every one interested in education likes to know about, but which are often hard to find.

— Moncure D. Conway writes in the May *Cosmopolitan* a lively article on 'The Pedigree of the Devil,' which is illustrated with a number of rare and weird pictures, including four pages in color.

Proceedings of Societies.

Philosophical Society, Washington.

April 28. — J. P. Iddings, On the Origin of Primary Quartz in basalt; J. R. Eastman Some Peculiarities in Personal Equation; Cooper Curtice, Cambrian Rocks in Tennessee.

Boston Society of Natural History.

May 2, *Election of Officers.* — President, F. W. Putnam; vice-presidents, John Cummings, G. L. Goodale; curator, Alpheus Hyatt; honorary secretary, Edward Burgess; secretary, J. Walter Fewkes; treasurer, Charles W. Scudder; librarian, J. Walter Fewkes.

Eadweard Muybridge, Animal Locomotion,— an Electro-Photographic Investigation of Consecutive Phases of Animal Movements.

Society of Arts, Boston.

April 26. — George F. Kunz, Precious Stones in the Last Decade.

May 10. — William A. Anthony, A Study of Alternating Generators and Receivers.

Publications received at Editor's Office, April 16-21.

ALDEN'S Manifold Cylopedia of Knowledge and Language. Vol. II. Amer. Brit. to Artemis. New York, J. B. Alden. 632 p. 12°. 50 cents.

——— The same. Vol. III. Artemisia to Baptisia. New York, J. B. Alden. 631 p. 12°. 50 cents.

——— The same. Vol. IV. Baptism to Bilberry. New York, J. B. Alden. 12°. 50 cents.

——— The same. Vol. V. Bilbilis to Brave. New York, J. B. Alden. 12°. 50 cents.

AMERICA. Vol. I. No. 1. *w.* Chicago, The Amer. Publ. Co., 1888. 16 p. f°. $3.50 per year.

AMERICAN Association for the Advancement of Science, Proceedings of the, at the Thirty-sixth Meeting, held at New York, August, 1887. Vol. XXXVI. Salem, A. A. A. S. 368 p. 8°.

BRIGGS, R. Steam Heating: an Exposition of the American Practice of warming Buildings by Steam. (Van Nostrand's Sc. Ser., No. 68) New York, Van-Nostrand. 122 p. 24°. 50 cents.

CANADA Geological and Natural History Survey, Summary Report of the Operations of the, to Dec. 31, 1887. Ottawa, MacLean, Roger, & Co., Pr. 40 p. 8°.

DULLES, C. W. Accidents and Emergencies. 3d ed. Philadelphia, Blakiston. 123 p. 16°. 75 cents.

ERDE, Die. Lief. 21-25. Leipzig, Hartleben. f°.

GILLMORE, Q. A. Notes on the Compressive Resistance of Freestone, Brick Piers, Hydraulic Cements, Mortars and Concretes. New York, Wiley. 198 p. 8°. $3 50.

LECONTE, Joseph. Evolution and its Relation to Religious Thought. New York, Appleton. 344 p. 12°. $1.50.

O'REILLY, J. B. Ethics of Boxing and Manly Sport. Boston, Ticknor. 358 p. 12°. $1.50.

PREYER, W. The Mind of the Child. Part I. The Senses and the Will. Tr. by H. W. Brown. (International Education Series, Vol. VII) New York, Appleton. 346 p. 12°. $1.50.

TYRRELL, J. B. Report on a Part of Northern Alberta, and Portions of Adjacent Districts of Assiniboia and Saskatchewan. Montreal, Dawson Bros. 176 p. 8°. 25 cents.

U. S. GEOLOGICAL SURVEY. Topographical Maps of Portions of New Jersey and Alabama. 14 maps, 42 by 50.5 cm. Washington, Government, 1888.

VESCELIUS-SHELDON, Louise. Yankee Girls in Zulu Land. New York, Worthington. 287 p. 12°. $2.25.

WEGMANN, E., Jr. The Design and Construction of Masonry Dams, giving the Method employed in determining the Profile of the Quaker Bridge Dam. New York, Wiley. 106 p. 4°. $5.

Positions Vacant.

Inquiries from employers in want of those skilled in any department of science in its widest sense will be inserted in this column WITHOUT CHARGE.

The labor and expense involved in ascertaining what positions are open, in gratuitously advertising them and in attending to the correspondence of applicants, are incurred in the interest and for the *exclusive* benefit of *subscribers* to *Science*.

Applicants should inclose the necessary postage, for forwarding their letters.

1 — A Professor will be appointed by the Board of Visitors to the Chair of Biology and Agriculture in the University of Virginia, on the 27th of June, 1888. The emoluments of the position are $3,000 per annum and a dwelling. Inquiries may be addressed to CHAS. S. VENABLE, *Chairman of the Faculty.*

Wants.

AN EDUCATED AND CAPABLE PERSON wanted in every town and city to canvass for subscriptions to *Science*; liberal compensation. Address, naming references, PUBLISHER OF SCIENCE, 47 Lafayette Place, New York city.

SCIENCE

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SCIENCE

FRIDAY, MAY 11, 1888.

THE GRAVE APPREHENSIONS as to the fate of Stanley's expedition, that are occasionally published in the daily papers, have no other foundation than the lack of any news since Stanley's departure from the mouth of the Aruvimi. We know from Junker's descriptions, that the region he has to pass through is a very difficult one, and that his original estimates of the time required to reach the Mvutan Nsige from the Kongo were too low. If any serious mishap should have occurred to him, exaggerated rumors would undoubtedly have reached the coast; for even in Africa a caravan of hundreds of men, including several white men, does not disappear never to be heard of again. News did not reach the lower Kongo, as no steamer has been able to visit Stanley Falls and the mouth of the Aruvimi since Stanley's departure. It is somewhat difficult to understand the reason for this state of affairs, except it may be that the steamers have suffered from their long-continued service, or are needed for the actual use of the stations near Leopoldville. The steamers of the missions and of the Sandford Exploring Expedition are not at the disposal of the Free State. The 'En Avant' has just returned from her great expedition up the Welle, and thus the number of available steamers was practically very small. Recent papers inform us that a new steamer, the 'Roi des Belges,' was launched on Stanley Pool Feb. 18, while the 'Ville de Bruxelles' is being transported to the upper Kongo. It is to be hoped that communication with the upper Kongo, which has practically been interrupted since the capture of Stanley Falls Station by the Arabs, — except when Stanley and Tippo-Tip ascended the Kongo, — will be resumed ere long.

WILLIAM C. WYCKOFF, late editor of the *American Magazine*, who died in Brooklyn last week, was well known among the scientific men of the United States. A few years ago, when the *New York Tribune* devoted much more space to scientific matters than now, Mr. Wyckoff, then a member of its editorial staff, reported the annual meetings of the American Association for the Advancement of Science; and it is doing him only justice to say that no equally good reports have ever been made for a daily newspaper, rarely if ever for a weekly or monthly journal devoted to science. He was singularly careful and painstaking as a reporter, and his work received wide recognition among those most interested in and best able to judge of it. The same conscientiousness characterized all of his work as a writer and editor. His service upon the *Tribune* extended through many years. More recently, as secretary of the Silk Association of America, he has published a number of very valuable volumes in relation to that industry. His latest work was upon the *American Magazine*, as its editor, which in one year he built up from the old *Brooklyn Magazine*. This work speaks for itself. Mr. Wyckoff had a very wide circle of acquaintances and friends in the journalistic profession.

THE PROJECT of having a refuge-hut high up on the main range of the White Mountains — one which should afford adequate shelter in any weather — has long been entertained by members of the Appalachian Mountain Club, and the council of the society believe that the time has come for an effort in this direction. It is their desire to build this summer a permanent stone cabin at Madison Spring, in the saddle between Mount Adams and Mount Madison, provided with sleeping-bunks, a stove, and the most necessary furniture. Cooking-utensils and axe would be kept there, and there is a good supply of fuel at hand. The structure will be useful in two ways: first, as a resting-point for persons who wish to visit the Northern Peaks, or to traverse the ridge to or from Mount Washington, but who have not the strength to accomplish these expeditions (distinctly the most interesting in the White Mountains) in a single day; second, as a comfortable camping-place for scientists, photographers, and lovers of scenery, who will be able to make prolonged stays in this interesting upper region, and be independent of the weather. The structure which the council have in mind will cost (at that altitude) from five hundred to seven hundred and fifty dollars, if built in a thorough manner. Until five hundred dollars are secured, it will hardly be prudent to begin the work. The council have appropriated one hundred and fifty dollars from the yearly income, and some subscriptions can probably be obtained outside; but at least three hundred dollars ought to be made up by subscriptions inside the club. The council make, therefore, an earnest appeal to all persons interested in this enterprise to indicate at once the sums they are willing to contribute. Assistance from any one interested will be gladly received. Subscriptions should be sent to the councillor of improvements, Frederic D. Allen, 10 Homboldt Street, Cambridge, Mass.

DR. EMIL BESSELS.

IN a recent number of *Science* we announced the death of Dr. Emil Bessels, who won so much well-deserved renown on the 'Polaris' expedition. The deceased was born in 1847 at Heidelberg. At an early age he left school and entered business, but his love of science prompted him to resume his studies. He became a student at the University of Heidelberg, and paid particular attention to zoölogy. His first publication of importance was on the distribution of the American deer. In 1869, at the instance of the late Dr. A. Petermann, he joined the first German polar expedition, which, although unsuccessful in its attempts to reach Gillis Land, made important discoveries in those parts of the Arctic Ocean lying between Spitzbergen and Nova Zembla. Particular attention was paid to observations on the temperature and salinity of the ocean. His work on this expedition had proved him to be an energetic worker and excellent observer; and when the American polar expedition was organized, in 1870, he was invited to join it as scientist. The progress and the events of this expedition are so well known that it is unnecessary to dwell upon them. It ought to be stated, however, that the scientific results are almost solely the work of the deceased. Setting aside the valuable geographical discoveries which Bessels made on excursions by sledge, and among which the exploration of Petermann Fiord ranks highest, his hydrographical and meteorological observations are of great importance. He was the first to give the explanation of foehn-like winds now universally adopted; he was the first to pronounce the insularity of Greenland, founding his conclusion upon the fact that the Atlantic tide entered the northern part of Robeson Channel. It will be remembered that his conclusions were fully corroborated by the discoveries of the Nares and Greely expeditions. After his return from the Arctic, he was engaged in working up the results of the expedition; but he had hardly finished this task, when he began to make preparations for a new expedition, the prime object of which was to be physical observations. He corresponded about his plans with Weyprecht and Dorst, and preparations were made; but, when all was ready, unfortunate events prevented the carrying-out of the plan, which would doubtlessly have resulted in great additions to our knowledge of the polar regions. During the last years of his life he resided in Washington, engaged in completing a work on physical geography and an anthropological work on the Eskimo, both of which he left unfinished. Besides this, he wrote a popular account of Eskimo life, which it is hoped will be published at an early date. When the first expeditions to the rescue of Greely were prepared, he strongly advocated that a well-equipped expedition be sent out at once. During this period he wrote his valuable contributions to the history of the American polar expeditions. He died while on a visit to his friends in Germany. His amiability will be remembered by all his friends. His valuable contributions to science will make scientists regret that he was not allowed to complete the numerous works he had begun, which would have secured to him one of the most prominent places among modern scientists.

THE COURSE OF HUMAN PROGRESS.[1]

THE course of human events is not an eternal round. In the wisdom of the ancients there are many proverbs to the effect that that which is, has been before and will be again. So far as human experience extends, unaided by reason, days and nights come and go, winter follows summer, and summer follows winter, and all the phenomena of nature seem to constitute an endless succession of recurrent events. But there is a higher knowledge which observes a progress by steps so minute that it was left to modern science to discover it. In the history of humanity the changes which result in progress are more readily perceived; and the aphorism of the ancients, that "there is nothing new under the sun," is but a proverb of ignorance.

Every child is born destitute of things possessed in manhood which distinguish him from the lower animals. Of all industries he is artless, of all institutions he is lawless, of all languages he is speechless, of all philosophies he is opinionless, of all reasoning he is thoughtless; but arts, institutions, languages, opinions, and mentations he acquires as the years go by. In all of these respects the new-born babe is hardly the peer of the new-born beast; but, as the years pass, ever and ever he exhibits his superiority in all of the great classes of activities, until the distance by which he is separated from infancy is so great that he seems to live in another realm. These activities that separate the man from the babe are the humanities. In like manner the human race has been segregated from the tribes of beasts by the gradual acquisition of these humanities, by the invention of arts, the establishment of institutions, the growth of languages, the formation of opinions, and the evolution of reason.

The road by which man has travelled away from purely animal life is very long; but this long way has its landmarks, so that it can be divided into parts. There are stages of human culture, and they have been denominated savagery, barbarism, and civilization.

All the grand classes of human activity are inter-related in such manner that one presupposes another, and no one can exist without all of the others. Arts are impossible without institutions, languages, opinions, and reasoning; and in like manner every one is developed by aid of the others. If, then, all of the grand classes of human activities are interdependent, any great change in one must effect corresponding change in the others. The five classes of activities must progress together. Art-stages must have corresponding institutional, linguistic, philosophic, and psychic stages.

Stages of progress common to all the five grand classes of human activities may properly be denominated culture-stages, and such culture-stages should be defined by characterizing all these activities in each stage. This I shall attempt to do, but in a brief way. [The lecturer then described savagery with regard to its arts, institutions, language, philosophy, and mind, and summed up his description in the following way.]

The savage has invented rude arts by which he obtains food, clothing, and shelter. He has invented a rude system of kinship society, with descent in the female line. He has spoken language, gesture-speech, and picture-writing, but is without hieroglyphic, syllabic, or alphabetic writing. He has a philosophy which informs conspicuous and important inanimate objects with spirit-life, and which deifies the brute; and a mind whose perceptions are so slightly developed that conventional characters do not convey ideas, and his arithmetic is yet counting. Such, in general, are the characteristics of all savage people that have been carefully studied by anthropologists.

How was this savagery transformed into barbarism, and what is that barbarism? [The lecturer began his answer to these questions by considering the change in arts.] There are two arts, intimately associated, the invention of which causes a radical change in all the departments of humanity; viz., agriculture and the domestication of animals. Agriculture began in savagery. Many savage tribes cultivate little patches of ground, and thereby provide themselves with a part of their subsistence. This petty agriculture does not of itself result in any radical change; but when the art has developed to such an extent that the people obtain their chief subsistence therefrom, and especially when it is connected to the domestication of animals, so that these are reared for food and used as beasts of burden, the change for which we seek is wrought. It seems that extensive agriculture was first practised in arid lands by means of artificial irrigation. In more humid lands the supply is more abundant and the incentive to agriculture is less. On the other hand, agriculture is more difficult in humid lands than in arid lands. The savage is provided with rude tools, and with them he can more easily train water upon desert soils than he can repress the growth of valueless plants as they compete for life with those which furnish food. The desert soil has no sod to be destroyed, no *chaparral* to be eradicated, no trees to be cut down with their great stumps to be extracted from the earth. The soil is ready for the seed. Throw upon that soil a handful of seed, and then sprinkle it with a few calabashes of water once or twice through the season, and the crop is raised; or train upon a larger garden-patch the water of a stream, and let it flood the surface once or twice a year, and a harvest may be reaped.

Petty agriculture, such as I have described as belonging properly to savagery, has been widely practised in the four quarters of the globe among savage people, quite as much in humid as in arid regions; but the art seems not to have indigenously extended beyond that stage in any but arid regions. The earliest real agriculture known to man was in the valley of the Nile, an almost rainless land, but the floods of the Nile were used to fertilize the soil; again, in the land of Babylon, along the Tigris and the Euphrates, extensive agriculture grew up, but it was dependent upon artificial irrigation; still farther to the south-east, in the Punjab, another system of indigenous agriculture was developed by utilizing the waters of the five great rivers; still farther to the east an indigenous agriculture was developed on an extensive scale, all dependent upon artificial irrigation, as the Chinese use the waters of the Hoang-ho and the Yang-tse-kiang; in South America the first system of agriculture was developed in Peru, all dependent upon artificial irrigation; and, finally, to the north of the Isthmus of Panama, in Central America and Mexico, agricultural art was highly developed, and here also they were dependent upon artificial irrigation. From these six examples of high agricultural art, all the agriculture of the world has been developed; from these centres it has spread. The petty agriculture of humid lands never went beyond the utilization of little patches of ground in the forest glades, until it was borrowed in a higher state from arid lands. Everywhere with the development of agriculture in the arid lands the art of domesticating animals was associated, and everywhere such animals were raised for food, and to a large extent they were used as beasts of burden.

[The lecturer, in continuation, showed how changes in the arts wrought changes in institutions, changes in language, changes in philosophy, and psychic changes during the transition period from savagery to barbarism, and summed up this portion of his discourse as follows.]

From the foregoing brief characterization it will be seen that barbaric culture implies a somewhat high state of agriculture and the domestication of animals, one or both; it implies that patriarchal institutions have been organized, that descent is in the male line, that ranks in society have been established, and that new laws regulating property have been enacted; it implies that the people use hieroglyphs; it implies that domestic worship is ancestral worship, that tribal worship is based on physitheism, and that the phenomena of the universe are attributed to nature-gods; and, finally,

[1] Lecture delivered May 5, by Major J. W. Powell, in the course of free lectures under the auspices of the Philosophical, Biological, and Anthropological Societies of Washington.

it implies that men can perceive meanings in conventional signs, and that arithmetic has been invented.

[The change from barbarism into civilization was next described.] In barbarism there are tools, but no machinery; metallurgical processes are yet undiscovered; the use and reduction of iron are unknown. The employment of the latter led to an important advance in naval architecture; to the accumulation of wealth in the products of the soil, in woven fabrics, in iron and copper and silver and gold; and these together to the establishment of a system of exchanges through fleets and caravans; and thus commerce was developed.

In barbarism the people lived largely in towns, each town being an independent body politic. But when commerce was developed, towns grew into cities, and with increasing wealth there was increasing temptation to predatory forays; and at the same time the discovery of bronze and copper had given the barbaric warriors superior arms. Then it became necessary to defend the cities with their wealth and teeming population, and they were walled. At this stage the people have learned to burn brick and to cut stone, and a vast improvement in architecture is the result. They have also become skilful in the manufacture and decoration of pottery; there are forges in the cities, and glass-manufactories flourish. Water-mills are set up, great irrigating ditches are built, and mines are opened.

It is not proposed to set forth the great industrial achievements of modern civilization by which the powers of nature have been discovered and utilized by mankind: it is simply intended to explain the first form of civilization, that it may be distinguished from anterior barbarism.

[Major Powell next treated of the change in institutions which marked the transition from barbarism to civilization.]

In setting forth the evolution of barbarism into civilization it becomes necessary to confine the exposition to eastern Europe, western Asia, and northern Africa, and to a large extent to one great stock of people, — the Aryan race, — together with those other stocks — as the Egyptian, the Semitic, and the Turanian races — whose history is involved in that of the Aryan, and with whom they were inextricably mixed, and whose ultimate destiny was controlled by the progress of Aryan culture. On the other hand, some Aryan people are not included, from the fact that they severed themselves from the body of the people and entered upon an independent history. The centre of this world was the Mediterranean Sea; and from its shores, far away in every direction, the peoples were scattered whose history was involved in one vast interdependent system, for the culture of every one re-acted upon the culture of every other one. Throughout all the region above indicated, tribal towns and nomadic villages existed. Gradually the most prosperous towns became centres of power and population. Less powerful tribes became subject to and dependent upon more powerful tribes, and gradually many tribal towns became city States, and these city States were transitional bodies politic between barbarism and civilization.

[The organization of a city State was then described, and the origin of ranks shown. The organization of city States into nations was then traced out, the nations being essentially tax-gathering bodies, with no attempt to re-organize the society of such nations so as to secure general homogeneity and interdependence of parts, and that unification which gives solidarity. This came later. The evolution of kingship, the contest between the throne and the Council or Parliament, the origin of courts, the development of civilized law, and the establishment of the authority of the superior in rank, were next explained. Thus it was shown that the institutional change from barbarism to civilization was a change first in the constitution of the State itself, a change in the form of government, a change in the principles of law. In like manner the change in language, the change in opinion, and the change in mentations was traced. Under the last head Major Powell spoke as follows.]

The most important acquisition to intellectual activity gained by man is the power of inductive reasoning beyond the penetration of the senses, and beyond sensuous conceptions, and into a realm in which conclusions are reached which are apparently contradicted by the senses and by experience.

[The following are the closing paragraphs of the lecture.]

I have thus endeavored to indicate the course of culture and characterize its three great stages by following a few lines of its evolution, and I will recapitulate in part, and add other particulars: but that the statement may be laconic, all qualifications and provisos must be neglected.

The age of savagery is the age of stone; the age of barbarism, the age of clay; the age of civilization, the age of iron. The savage propels his canoe with a paddle; the barbarian propels his boat with oars; the civilized man navigates the sea with ships propelled by sails. In savagery, music is only rhythm; in barbarism it is rhythm and melody; in civilization it is rhythm, melody, and harmony. The age of savagery is the age of kinship clan, when maternal kinship is held most sacred; the age of barbarism is the age of kinship tribes, when paternal kinship is held most sacred; the age of civilization is the age of nations, when territorial boundaries are held most sacred. In savagery, law is designed to secure peace; in barbarism, to secure peace and authority; in civilization, to secure peace, authority, and justice. In savagery, law extends only to kindred; in barbarism, to kindred and retainers; in civilization, to all people of the nation. The age of savagery is the age of sentence-words; the age of barbarism, the age of phrase-words; the age of civilization, the age of idea-words. In savagery, picture-writings are used; in barbarism, hieroglyphics; in civilization, alphabets. In savagery there is no verb 'to be;' in barbarism there is no verb 'to read;' in civilization, verbs are resolved into parts of speech. In savagery, beast-polytheism prevails; in barbarism, nature-polytheism; in civilization, monotheism. In savagery a wolf is an oracular god; in barbarism it is a howling beast; in civilization it is a connecting link in systematic zoölogy. In savagery the powers of nature are feared as evil demons; in barbarism the powers of nature are worshipped as gods; in civilization the powers of nature are apprenticed servants. In savagery, men can only count; in barbarism they have arithmetic; in civilization they understand geometry. In savagery, vision is limited by opinion; in barbarism, vision is limited by horizon; in civilization, vision is limited by the powers of the telescope and microscope. In savagery, reason is based on zoömorphic analogies; in barbarism, on anthropomorphic analogies; in civilization, on intrinsic homologies. The great intellectual achievement of savagery was the discovery of the difference between the animate and the inanimate, between the organic and inorganic, between the living world and the dead world, but, the discovery having been made, the animals were deified and believed to be the authors and movers of the world of phenomena; the greatest intellectual achievement of barbarism was the discovery of the limited powers of animals, but, the discovery having been made, the powers and wonders of nature were deified and given the forms of man; the greatest intellectual achievement of civilization was the discovery of the physical explanation of the powers and wonders of the universe, and the intellectual superiority of man, by which he becomes the master of those powers, and the worker of wonders. In savagery the beasts are gods; in barbarism the gods are men; in civilization, men are as gods, knowing good from evil.

The story of human culture is a story of transformations: arts have transformed, institutions have transformed, language has been transformed, opinions have been transformed, and reason has been transformed. There are many strange transfigurations in nature. It is a wonder that the blows of the hammer are transmuted into heat; it is a wonder that the motions of the ether can be transmuted into the rainbow; it is a wonder that the egg can be transmuted into the eagle; it is a wonder that the babe can be transmuted into the sage; it is a wonder that an objective blow may be transmuted into subjective pain; it is a wonder that the printed page may be transmuted into visions of the beautiful: but the wonder of wonders is the transfiguration of selfishness into love. Amatory passion transfigured appears as love; parental care, as parental love; infantile dependence, as filial love; fraternal sympathy, as fraternal love. Thus love of kindred was born; and the love of kindred, by the expansion of the kinship body into the tribe and nation, grew to love of country and love of mankind. The last transfiguration in the process of evolution appears as the ethics of mankind.

Man, so far as he is superior to the beast, is the master of his own destiny, and not the creature of the environment. He adapts the natural environment to his wants, and thus creates an environment for himself. Thus it is that we do not discover an aquatic variety of man; yet he dwells upon the sea, and derives sustentation from the animals thereof by means of his arts. An arboreal variety of man is not discovered, but the forests are used in his arts, and the fruits of the forests for his sustentation. An aerial variety of man is not discovered, but he uses the winds to propel his machinery and to drive his sails; and, indeed, he can ride upon the air with wings of his own invention. A boreal variety of man is not discovered, but he can dwell among the everlasting snows by providing architectural shelter, artificial warmth, and bodily protection.

Under the influences of the desert, a few plants secure a constitution by which the moisture imbibed during brief and intermittent rains is not evaporated: they become incrusted with a non-porous glaze, or contract themselves into the smallest space, and exist without life, until the rain comes again. Man lives in the desert by guiding a river thereon and fertilizing the sands with its waters, and the desert is covered with fields and gardens and homes. Everywhere he rises superior to physical nature. The angry sea may not lash him with its waves; for on the billows he builds a palace, and journeys from land to land. When the storm rises, it is signalled from afar, and he gathers his loved ones under the shelter of his home, and they listen to the melody of the rain on the roof. When the winds of winter blow, he kindles fossil sunshine on his hearth and sings the song of the Ingleside. When night covers the earth with darkness, he illumines his path with lightning light. For disease he discovers antidote; for pain, nepenthe; and he gains health and long life by sanitation; and ever is he utilizing the materials of nature, and ever controlling its powers. By his arts, institutions, languages, and philosophies he has organized a new kingdom of matter over which he rules. The beasts of the field, the birds of the air, the denizens of the waters, the winds, the waves, the rivers, the seas, the mountains, the valleys, are his subjects. The powers of nature are his servants, and the granite earth his throne.

INFLUENCE OF FORESTS UPON THE CLIMATE OF AUSTRALIA.

IN connection with the discussion that is going on at the present time in reference to the influence of forests upon rainfall in the western parts of the United States, the following remarks of Dr. R. von Lendenfeld on the influence of deforestation upon the climate of Australia, which were published in the February number of *Petermann's Mitteilungen*, will be of interest. The influence of the forest upon the climate in the damp regions of the temperate zone, for instance in central Europe, is undoubtedly such as to increase the humidity of a place. The roots of the trees, forming a network, retain the earth on steep slopes, and thus prevent the water from running off rapidly. On slopes without forest or vegetation the water rushes downward: it is collected in streamlets and rivers, and carried into the ocean before much, if any, evaporation has taken place.

Evidently a great part of the rain falling in a wooded country is evaporated before it can flow off, as the roots of the trees retard its collection in brooks and rivers. Lendenfeld has made some preliminary computations which lead him to the conclusion that about twenty-five per cent of the rain falling in wooded regions of the temperate zone, such as central Europe, are due to the influence of the forest. A country grown with grass and herbs would also have more rain than one in which the bare rocks were exposed to the air.

In Australia the influence of the forest is entirely different from what it is in Europe. The views of those Australians who are principally interested in this matter are divided. The general opinion is that the climate is becoming dryer in consequence of deforestation. Others, however, maintain that the cutting-down of the woods has no influence whatever upon the climate, and that, if such an influence should exist, it is so small as to be of no account, compared to the advantages connected with the deforestation. The latter view is principally held by squatters and ranchmen, who, of course, have an immediate interest in the opening of forest-land for agricultural and stock-raising purposes, and who cannot be expected to be unbiassed.

Australia is a very dry country, its northern portion alone being exposed to tropical rains. Besides this, only the south-eastern part is mountainous, which has elevations exceeding six thousand feet in height. These elevations — the Australian Alps — materially increase the amount of rain, and thus cause the great productivity of the colonies of New South Wales and Victoria.

Setting aside the Alps and the east coast, the whole of Australia is very dry. The interior is almost rainless; and even near the coast, in the greater part of New South Wales and Victoria, the amount of rain is very small, and does not reach the height of eight inches, while the evaporation amounts to ten feet. In the interior, rain is very rare, occurring only once in a period of about three years. In countries where long-continued droughts prevail, such plants as grow in humid regions cannot live. All plants of the desert, and among them the trees, shrubs, and grasses of the steppes of Australia, have certain means for increasing the water-supply from the deeper layers of the soil (i.e., roots extending to great depths), and others for diminishing evaporation. The *stomata* of many *Eucalypti* are removed from the surface of the leaf, and those of the *Spinifex* of the deserts are protected by a peculiar arrangement. Leitgeb, who has studied the movability of the cells of the *stomata*, found that they close the aperture the more, the less the water at the disposal of the plant.

Besides these well-known facts, Lendenfeld observed that the *stomata* of the leaves of *Eucalyptus* are perfectly closed whenever a hot and dry wind is blowing, so that in such cases no evaporation to speak of takes place. Therefore the same wind which is so dangerous to grasses and herbs has almost no influence whatever upon the *Eucalyptus* trees. Furthermore, Lendenfeld concludes that probably most plants of the desert have their *stomata* closed during the day-time, while they are open during the night. It is only then that carbonic acid enters the plant, and is dissolved in the sap. In the morning they close the *stomata*, and assimilation begins under the influence of the light. The carbonic acid dissolved during the night is decomposed, and the oxygen escapes through the epidermis.

It has been shown by Volkens, that during the latter part of the night the atmosphere, even of the desert, is to a greater or less degree saturated with vapor: therefore the plants do not lose much water by opening their *stomata* at night.

Almost all trees and shrubs of the interior of Australia produce ethereal oils in great quantities. In evaporating, it lessens the temperature of the leaves, and forms a layer of vapor all over the forest. According to Tyndall, air saturated with ether is less permeable for radiant heat than ordinary atmospheric air: thus the tree protects itself by means of a cover of ether from excessive heat and evaporation. As the leaves of the *Eucalyptus* trees turn their edges towards the sun, the effect of insolation is very slight. Thus it is shown that the trees and shrubs of the arid parts of Australia are well equipped to resist the dryness of the climate.

But, besides these plants, numerous small grasses and herbs occur, which Lendenfeld, following Volkens's example, calls ephemeric. They are not at all protected against evaporation. Their roots do not penetrate the soil to any great depth, and their *stomata* are open in the day-time. As their seeds are spread all over the ground in great quantities, they grow up rapidly after every rainfall, and cover the bare ground with a fresh green. They are the principal food of the sheep.

As long as water remains in the upper layers of the soil, the ephemeric plants grow. As soon, however, as the stock of water is used up, they die, as their roots do not extend deep enough. The roots of the trees spread from ten to fifteen feet below the surface of the ground, and absorb all the humidity of these layers which otherwise would gradually reach the surface in consequence of capillary attraction. Thus they prevent the stock of deep water from supplying the needs of the grasses.

In all temperate and humid countries the struggle of the plants is for light. In the interior of Australia, and in other similar subtropical regions, they struggle for water. Thus the ephemeric plants are here killed by the trees, and in wooded countries they do not occur at all.

Lendenfeld, while travelling through the wooded parts of Australia for days and days, did not observe a single blade of grass. The soil, which consisted to a great extent of red clay, was smooth as asphalt pavement, and hard as rock. Rain, when falling on such soil, does not penetrate it, but runs off rapidly. The low-lying regions are inundated; but it appears that the water is not evaporated there, but flows through subterranean channels into the ocean. There are no rivers with large watersheds in Australia. Even the largest river, the Murray, is navigable only in winter and for light steamboats.

The water runs off so quickly that it has hardly time to penetrate the hard and smooth ground. The woods, therefore, do not increase the humidity of the soil and of the air.

In many places the squatters begin to cut down the trees, so far as the laws permit their doing so. The local effect is marvellous. Lendenfeld observed that so many kinds of grasses began to grow, that on the same space on which, before the cutting-down of the trees, only one hundred sheep could be raised, a thousand found sufficient food.

This effect is brought about in the following way. As the trees do not absorb the humidity of the deep layers of the ground, it reaches the surface and is absorbed by the grasses. The decaying stems of the grasses form small channels in the soil, which lead to larger ones that were formerly occupied by the roots of the trees. Thus the ground becomes permeable for water. When rain falls, it runs off slowly, as the grasses hinder its movements. It penetrates the ground, and thus a greater portion of the total amount of rainfall benefits the spot at which it falls. Part of it evaporates, and thus increases the humidity of the air.

It has been said that the springs become more numerous by the cutting-down of the woods, as the grasses do not use the humidity of the deeper layers of the ground. Lendenfeld, however, maintains that the increase of water carried by the springs is not as great as the increase of water retained in the soil through the action of the grasses, and that a great part of the water of springs is evaporated, and increases the humidity of the air.

From all these facts, Lendenfeld concludes that in Australia the effect of deforesting the country is not a decrease, but an increase, of rainfall.

NEW ZEALAND LETTER.

THE long-continued commercial depression under which this colony still labors affects every class of the community, and is working a quiet, but in some respects much-needed, revolution in the habits of the people. There is no doubt that the colonists in former years had no ideas of economy in any direction; but these are now being forced on their notice in all sorts of ways. Early in last session of the Colonial Parliament, the Stout-Vogel ministry was overthrown, and Major (now Sir Harry) Atkinson assumed the reins of office, under strict pledges to enforce retrenchment in every possible direction. As far as the public can judge, these pledges are being fulfilled fearlessly and without favor.

In matters educational the primary-school system and the University of New Zealand come directly upon government for assistance. The former is altogether, and the latter to a considerable extent, dependent upon the annual appropriations made by the legislature. Considerable reductions have been made in the amount allotted for primary schools; but, as is so often the case, these reductions have not been effected in perhaps the best directions. Thus it was considered advisable to contract the school age at one or both ends. At present it commences at five years of age, and it was proposed to raise it to six. This would have disposed of the charge so often brought against the infant classes, especially of country schools, that they are merely convenient nursing-depots, where the younger children of a family are kept warm and out of mischief for a great part of each day. But the House of Representatives, in their wisdom, saw fit to retain the school age at five, but to knock off the highest or seventh standard. In times of depression, when it is difficult to find occupation for either old or young, it is commonly noticed that boys who have completed their sixth standard work are sent adrift to loaf on their parents, who cannot get them any work to do. For such a class alone, it would have been economy to keep the upper standards open, even had a small fee been charged. No education is so bad as that of the streets and of enforced idleness.

Another possible and profitable source of retrenchment in this much-overgoverned community would have been the abolition of some of the smaller education boards. It seems absurd, that, with a small population of some six hundred thousand, there should be something like twelve education boards, each with its paid staff of officials, — secretary, inspectors, etc. The abolition of at least six of these would have made a substantial reduction in the education vote: but, as it would have weakened or endangered the position of many of our precious representatives, it was not even considered, but, instead, the training-colleges at Auckland and Wellington were abolished; so that no adequate provision now exists in the North Island for the education of teachers. The free, secular, and compulsory system of primary education of this colony is one of the things the community is proud of, but it is a decidedly retrograde step when provision for adequately training its teachers is not made.

Secondary school education is all carried on in specially endowed schools, governed mainly by separate boards, and practically independent of the education department. Private enterprise in this direction is so handicapped by the endowments, that, except in a few cases of very special class schools, there are no private schools in the colony. A determined effort is made by a certain section of politicians to capitalize all these endowments for the benefit of the colony, and especially of primary education, and thus make secondary education dependent upon the support it might receive from those classes most able to provide it. Such a measure, if carried into effect, would close the avenues of the higher education to the poorer classes; while at present, owing to the low fees charged at the high schools (averaging from $50 to $62.50 per annum), and to the liberal provision made for scholarships, every boy or girl of promise in the primary school has a good chance of continuing his or her education in higher subjects at the public expense. While the secondary schools have not, in most cases, been retrenched directly, yet, as the revenues from their endowments have in nearly every case fallen considerably, the salaries of all their teachers have had to be correspondingly reduced.

The teaching of science occupies a very fair place in the curricula of New Zealand schools. In the primary schools very little is attempted beyond a few lessons in physics, physiology, or chemistry in the higher classes of the better schools. But alongside of this, rather heavy demands are made upon teachers going up for their examinations. Indeed, some knowledge of so many science subjects is demanded of them, that this part of the examination for classification defeats its own object. Were each teacher permitted to select one or two branches of science, and were they expected to attain a fairly high standard of efficiency in it, the introduction of really good science-teaching in the schools would soon follow, and indeed could be demanded.

In the secondary schools, provision of a kind is usually made for teaching one or two branches, although in only two schools in the colony is there a science-teacher who is a specialist. In most cases one of the staff is selected for his knowledge of some scientific subject; while the head master, being nearly always a classical scholar, does not, as a rule, attach a very high value to this department of school-work. This, however, is counterbalanced to a great extent by the importance which the New Zealand University attaches to science in its junior scholarship examinations, whose requirements constitute in many cases the guiding lines of the curricula of the high schools. For example: at the examination held last December, out of 60 candidates, 12 offered in botany, 26 in chemistry, 11 in mechanics, 14 in heat, 6 in electricity, and 1 in sound and light; that is to say, that, as each candidate who took science had to select any two subjects, 35 had offered themselves in this section of the examination. Most of the schools have either a small laboratory or at least a small stock of materials for teaching chemistry and some elementary physics, but little or none for the more specialized branches of the latter.

It is difficult for one not acquainted with the actual standards attempted, and the results gained, in schools of other countries, to compare the work done in our educational establishments with that done elsewhere. At the same time it is a fact that the medical students, who, after taking the early part of their training in the colonial high schools and colleges, proceed to Edinburgh to complete their course, invariably give a very good account of themselves.

In matters of purely scientific interest there is but little to chronicle at present from the colony. The want of money seems to have paralyzed even much of the available energy of the colonists; many men who formerly thought themselves in possession of a competency for the rest of their lives, being under the necessity again of commencing the grim battle for bread. It must be borne in mind that there is practically no cultured class in the colony, outside of those who are compelled to work. The scientific research and work which have been put forth from these islands have been done usually in the course of, or in the intervals of, hard professional work, by settlers, surveyors, medical men, lawyers, and teachers. There is only one purely scientific association for the whole colony, — the New Zealand Institute; formed, however, of a number of affiliated societies, each having its own rules, office-bearers, funds, etc. The chief of these are the Auckland Institute, the Wellington Philosophical Society, the Philosophical Institute of Canterbury (meeting in Christchurch), and the Otago Institute (meeting in Dunedin). Besides these, there are smaller branches at Napier, Nelson, Hokitika, and Invercargill. The central body, termed the New Zealand Institute, is practically only an administrative board, partly elected by the affiliated societies, but chiefly nominated by the governor. This body is charged with the publication of the papers on scientific matters, which are read before the various affiliated societies; and these constitute a bulky octavo volume, containing last year nearly seven hundred pages. The management of the whole is in the hands of Sir James Hector, director of the Geological Survey, who indeed has been the central figure of the institute since its establishment in 1867. A government grant of £500 per annum meets the chief cost of publishing the annual volume of Transactions and Proceedings, but this is occasionally supplemented by small levies on the affiliated bodies. The total number of members of the various branches of the institute is about 1,250, — a most creditable number, when the population of the colony is considered, and when it is borne in mind that each of these is a voluntary member and subscriber to the extent of at least a guinea a year. The pages of the nineteen volumes of Transactions teem with valuable papers on many branches of natural science, zoölogy and botany having the largest number of votaries. The isolated position of the colony makes the study of its groups of plants and animals peculiarly complete from the point of view of geographical distribution. Hence many European specialists have devoted some of their time to working out all the New Zealand forms of one or other group. Thus at present Baron Osten-Sacken is engaged on the *Diptera*, — a group regarding which very little is known in the colony, but the members of which take a large share in the fertilization of its flowering plants. Mr. E. Meyrick has systematically studied many groups of the *Micro-lepidoptera*, and is still engaged on others. The New Zealand *Araneæ* were formerly only known from the Rev. O. Pickard-Cambridge's papers, in the London Zoölogical Society's Transactions. Now, however, they are being taken up by Messrs. Urquhart of Auckland, and Goyen of Dunedin, both of whom are doing very good work. At present, as has mostly been the case in the past, the chief work done in the colony has been systematic; and even this has been done under great difficulties, the principal one being the impossibility of consulting all the literature of any subject.

Some two years ago the Royal Society of England made a grant to Prof. T. J. Parker of Dunedin to aid him in working out the embryology of the Tuatera lizard (*Sphenodon*), and also of the Kiwi (*Apteryx*). Living specimens of the former were obtained and kept in confinement both by Professor Parker and by Professor Thomas of Auckland, but up to the present time no eggs have been laid. But the study of the embryological development of *Apteryx* has been prosecuted much more successfully, and zoölogists may shortly expect a communication on the subject to the Royal Society, which will contain many points of interest.

Matters geological, especially those relating to mining, bulk much more largely in people's minds here than any other questions of a scientific kind. It is felt that New Zealand must look in the future more to her mineral wealth for her prosperity than ever she has done in the past, and it is in this quarter that most of the available capital is being directed — or, one might say, misdirected. A great amount of money is sunk in unscientific ways of mining and of prospecting. The country teems with mineral wealth, but it wants more knowledge, and less blind working. Very many of the mining ventures have turned out, as indeed is the case everywhere, unsatisfactorily. Copper-mines have been opened in various parts, but none are now in operation. Antimony occurs abundantly, but has never been profitably worked. The enormous deposits of iron-sand on our sea-beaches are still practically unworked. An attempt is being made to work the oil-bearing beds of the east coast of the North Island, but it is impossible to see how the projectors can successfully compete against the cheap oils of Pennsylvania. The one great stand-by of the colony is gold, and the crying want of the miners is some method of saving the fine gold which at present is lost. When it is seen that the 'tailings' of the famous Blue Spur diggings, which have been washed over several times, are still being sluiced by Chinamen who are making from two dollars to three dollars a day, it is clear that the art of gold-saving is still in its infancy.

Within the last few months a number of Wellman's dredges have been constructed to attack the beaches of auriferous sand and the river-beds. As these come into use, the quantity of gold obtained will be increased, and the available extent of field much enlarged.

G. M. T.

Dunedin, Feb. 23.

GRÜNWALD'S THEORY OF SPECTRUM ANALYSIS.

There has lately been advanced by Professor Grünwald of Prague a theory of the change which the spectrum of a substance undergoes when that substance enters into combination with another, that is so extremely simple that it is difficult to see how it can possibly be true. But the number and exactness of the coincidences that Professor Grünwald has observed are such as to arrest attention, and give some interest to the theory which is based on them.

The discoverer states, that, by a mathematical investigation of the changes which the spectra of two gases undergo when brought into chemical combination, he has been able to establish a law, as simple as it is important, which may be the basis of a future mathematico-chemical analysis; and by the aid of this law he has been able not only to establish a very remarkable relation between the spectra of hydrogen and oxygen on the one hand, and that of water-vapor on the other, but also to discover the chemical composition and structure of hydrogen and oxygen, and bring out the facts of the dissociation of hydrogen in the atmosphere of the sun.

The fundamental theorem of this new mode of analysis is as follows. Suppose we have a chemical element a, which, when combined with some other elements, forms a gaseous substance A. When the gas A unites with some other substance, a chemical compound B is formed, in which the element a is also contained, but in a different condition from that in which it existed in A. Usually the atomic volume of the substance a, reckoned in the ordinary way in use among chemists, will be different in the last case from what it was in the first, and the ratio of the atomic volumes in the two cases will be expressed as a ratio of two simple whole numbers. The above being granted, the theorem asserts that those wave-lengths of light in the spectrum of the substance A that belong to the element a are to the wave-lengths due to that element in the spectrum of the substance B in the same ratio as the atomic volume of a in A is to its atomic volume in B.

It follows from the above, that, when the atomic volume is unchanged by the combination, the wave-lengths of the lines due to the substance will be the same in both cases. But great variation between the spectra may exist notwithstanding, because, as Professor Grünwald remarks, the amplitudes of some of its modes of vibration may well be very different in the one case from what they are in the other. This, of course, means that the intensities of lines may be so different in the two cases that stray lines in the one spectrum may be so faint as to seem entirely lacking in the other. Thus, when hydrogen combines with chlorine, bromine, or iodine, the resulting gases, HCl, HBr, and HI, are formed without change in atomic volume; and hence the spectrum of HCl, for example consists simply of the spectrum of hydrogen combined with that of chlorine, with certain changes in the intensity of some lines.

In comparing the spectra of hydrogen and water-vapor, it was found that wave-lengths of the lines of the so-called H^d or compound line-spectrum of hydrogen, which has been investigated by Hasselberg, were twice those of the corresponding lines in the water-vapor spectrum. This conclusion was arrived at by comparing with the comparatively few lines of the water-spectrum that were accessible at the time. To test the conclusion, however, a list of wave-lengths that should be in the water spectrum was drawn up and sent to Professor Liveing at Cambridge, and the wave-lengths compared with those obtained by Liveing and Dewar in their recent experiments. As the result of this comparison, the author publishes a list of nearly sixty lines between wave-length 2800 and 2450, in which to each estimated line there corresponds an observed one; the difference between the observed and calculated wave-lengths in no case amounting to more than one Angstrom unit, or 1 part in 2,500.

The author therefore concludes, on the basis of his theory, that hydrogen, in that condition in which it gives this second or compound line-spectrum, occupies twice the atomic volume which it has in water-vapor.

The primary or elementary line-spectrum of hydrogen, however, it was found might be divided into two groups of lines, in such a manner that the wave-lengths of the one group when multiplied by $\frac{13}{30}$, and of the other when multiplied by $\frac{4}{5}$, gave the wave-lengths of the corresponding lines in the H_2O spectrum. Whence the author, by means of his fundamental theorem, reasons thus: hydrogen is formed of two primary elements, which may be designated a and b, and which give rise to the two parts of the elementary hydrogen spectrum under each other's influence. Let a and b represent the volumes of these two substances respectively in unit-volume of hydrogen; then $a + b = 1$; and, since hydrogen occupies two-thirds the atomic volume in water-vapor that it does in the primary condition, from the fundamental theorem we have

$$\tfrac{13}{30}a + \tfrac{4}{5}b = \tfrac{2}{3}.$$

From these two equations,

$$a = \tfrac{4}{5}, \quad b = \tfrac{1}{5};$$

therefore hydrogen is a combination of the form $H = ba$, and is thus analogous to ammonium (NH_4), and, as Professor Grünwald asserts, will, on dissociation, expand in the ratio of 3 to 2.

The primary element a must be a gas many times lighter than hydrogen. The spectra of these two elements, a and b, in the free condition may be at once obtained from the hydrogen spectrum by the previous theorem, when it is granted that the gas, on dissociation, expands in the ratio of 3 to 2; for we have only to multiply the wave-lengths of the group a in the hydrogen spectrum by $\frac{2}{3}$ to obtain those of the substance a in the free condition; and in like manner the wave-lengths of the substance b may be obtained from the corresponding group b.

Professor Grünwald has tabulated five lines in the spectrum of a between wave-lengths 9842 and 5653, and about forty lines of the spectrum of b, and each is found to correspond with a line in the solar spectrum. He concludes, therefore, that hydrogen, in the dissociated condition, exists in the sun, and identifies one of the lines of b with the so-called Helium line, 5874.9 of Angstrom's scale, while reasons are given for believing the corona line (1,474 of Kirchoff's map) is one of those in the spectrum of a. These two component elements of hydrogen he therefore suggests might be named 'Coronium' and 'Helium.'

From similar considerations to those employed in the case of hydrogen, oxygen, in its simplest molecular condition, is found to consist of the modified hydrogen, which gives the secondary spectrum before mentioned, with an equal volume of a substance O′, with which it combines without change of volume. This O′ is a combination of four parts by volume of the same element (b) which was found in hydrogen, with five parts of another substance (O″), which is itself composed of four parts of b with five parts of an unknown primary substance c. The formula expressing the above is,

$$O = H' \, [b_4(b_4c_5)_5].$$

In a long paper published in December in the *Sitzungsberichte der Kais. Akad. der Wissenschaften* of Bohemia, Professor Grünwald has extended his work to the spectra of magnesium and carbon, employing the wave-lengths as determined by Liveing and Dewar, and Hartley and Adeney, with the result that the spectrum of magnesium may be separated into four groups. The first is due to 'Helium,' neither 'condensed nor dilated;' the second is that of the primary element c in the condition in which it exists in oxygen; the third is that of b in the state in which it exists in free hydrogen; while the fourth is caused by the same element b, but in the chemically more 'condensed' state in which it exists in water-vapor.

There are still a number of weak magnesium lines which fall naturally into these groups, but the corresponding lines to which in the hydrogen and oxygen spectra are not known to exist. Carbon has similarly been resolved into a certain compound of these elements b and c.

These speculations will require most thorough investigation and testing before they can be accepted; but the first point to be seriously examined is the basis on which they rest. If the coincidences reported by Professor Grünwald, when examined carefully, are found sufficiently close and numerous to prove that a large group of lines in the spectrum of one substance can be obtained by simple multiplication by a constant multiplier from a corresponding group in the spectrum of another substance, and if there is any other fact, such as the regular periodic arrangement of the lines, which would seem to connect that group of lines together, then it is one of the most important facts which have yet been developed in connection with spectra. But it is necessary that the agreement should be of the same order of accuracy as the errors in the determination of wave-lengths, and there should appear some other fact connecting a group of lines together. As to the 'condensation' theory, nothing need be said until the facts are more thoroughly worked up; but the remark of its author, that the intensity of the lines due to a substance will experience great differences in intensity in different combinations, while undoubtedly true, gives great elasticity to the theory, and admits of its adaptation to so wide a range of facts as to seriously weaken the evidence advanced in its favor.

HEALTH MATTERS.

Diphtheria in New York.

THE prevalence of diphtheria in New York and Brooklyn has awakened a renewed interest in the means for its prevention. A paper on this subject was recently read by Dr. A. Caillé before the New York Academy of Medicine, and is reported in the *New York Medical Journal*. It had been his experience, as it probably had that of many other physicians, that in certain families one or more members regularly had diphtheria in the spring or autumn. This was particularly true of children. It had occurred to him that such persons might harbor the microbes, or other essentials to the development of the disease, in the nasal and oral cavities. The germs of diphtheria would readily take hold of damaged mucous membrane.

In trying to establish the correctness or fallacy of this view of self-infection, he had selected eight cases, in all of which the patients had suffered from true diphtheria twice or more prior to October, 1885. The families were well known to him, and they had occupied the same houses or had the same surroundings for a number of years. The parents of the children were intelligent enough to carry out his instructions. All carious teeth were to be filled or extracted, the teeth to be examined from time to time; the mouth was to be thoroughly rinsed three times a day, after each meal, with either a three-per-cent solution of chlorate of potassium in water, a five-per-cent solution of *liquor sodæ chloratæ*, or a saturated solution of borax in water. Besides using it as a mouth wash and gargle, some of the solution was to be drawn into the nose. From October, 1885, to December, 1887, not one of the persons experimented upon suffered from diphtheria, although five of them had several attacks of acute pharyngitis and amygdalitis. There was diphtheria in the family of three of the number, but they did not contract the disease. While these cases were insufficient to furnish absolute proof of the benefit of such prophylactic measures, yet they went far to establish the belief, that, if the nasal and oral cavities were kept clean by a mild antiseptic solution, the frequency of diphtheritic inflammation would be decidedly reduced.

In the discussion which followed, Dr. A. Jacobi, president of the academy, said that he believed it to be true that the diphtheritic poison could remain in the mucous membrane, and particularly in the neighboring lymphatic glands. Persons with a healthy mouth and pharynx were less easily infected than those who had catarrh of any form. The slightest scratch might give rise to erysipelas, and the same was true of diphtheria. One point in the prevention of diphtheria was of great importance: everybody had seen cases in which the patient was apparently about getting well, but suddenly had a new attack; and the attacks might thus be renewed four or five times. This was due to infection from the curtains or other things in the room occupied by the sick. In these cases prevention of renewed attacks was possible. If there were only two rooms, the child should be transferred from the one to the other at intervals of a few days, and the vacant room cleansed and thoroughly ventilated, and, if possible, disinfected. Dr. Holt believed that enlarged tonsils favored the development, and made the attack more severe.

DIPHTHERIA CARRIED BY TURKEYS. — Dr. Paulinis, in the *Bulletin Médical*, reports a most interesting epidemic of diphtheria which occurred in Skiatos, one of the Grecian isles, in the year 1884. The population of this island at the time was about four thousand. Dr. Bild, an old practitioner, is the authority for the statement that for thirty years no case of diphtheria had been known on the island. In June a child aged twelve years was attacked with diphtheria, and died. Seven other cases occurred in the immediate neighborhood: five of these died. The disease extended, until, within a period of five months, one hundred persons were attacked, of which number thirty-six died. Three weeks before the sickness of the first child, a flock of turkeys arrived from Salonica. Two of these were sick on arrival, and each of the others was subsequently attacked. Dr. Paulinis found in the throats of the sick ones patches of false membrane. The glands of the neck were swollen, and in one bird the disease had extended to the larynx, making it hoarse. One of the turkeys, after recovery, had paralysis of the legs, and was unable to walk. Although there had been no immediate contact between the sick birds and the first child attacked, still the distance between them was slight, and a wind had been for some time blowing in a direction favorable to the transportation of the disease. Dr. Paulinis believed that the disease was contracted from the turkeys, its germs being carried by the currents of air.

LEAD IN WATER. — From a report on the recent progress in public hygiene by Dr. Samuel W. Abbott to the *Boston Medical and Surgical Journal*, we abstract the following: In Sheffield, England, cases of lead-poisoning have been very frequent; during the past winter there has been an alarming increase, the number amounting to several hundred. On inquiry, it was found that these were quite exclusively among the population supplied from the high-service reservoir, in the water of which lead was found in quantity varying from half a grain to one and a quarter grains per gallon. This water was found to be distinctly acid, claimed to be of vegetable origin, arising from the peat upon the moors. To neutralize this acid, and thus prevent its dissolving the lead in the pipes, blocks of limestone have been placed in the conduit by the water company. The public analyst does not approve of this, saying that too much limestone will injure the water, and render it as liable to act on lead as if it had not been thus treated. He advises that the lime be introduced regularly and constantly in powder, or as milk of lime. Charcoal filters have been efficacious in removing the lead, in consequence of the phosphates contained in the animal charcoal used, forming an insoluble phosphate of lead.

PURE WATER FOR VIENNA. — Since the introduction into Vienna of a pure water-supply, the mortality from typhoid-fever has been greatly reduced, as well as that from other diseases. Since 1880 there has not been a death from dysentery in the city. Up to 1861 there were ten thousand wells in use in the city, and also public and private aqueducts bringing water from the Danube Canal. Although it is not so stated, we infer that these all have been abandoned. As a result of this improvement in the public health of Vienna, it would appear that water is the principal agent in the transmission of typhoid-fever, and that, in order to cause this disease almost entirely to disappear from a large city where it is endemic, it is only necessary to furnish to the inhabitants water of unquestionable purity, and in sufficient quantity.

DISINFECTION OF LIBRARY BOOKS. — The danger of infection from the use of books from circulating libraries has received intelligent attention in England, and means have been devised for their disinfection. The principal on which disinfection is based is the vaporization of carbolic acid by heat, whereby it is claimed that its action is more potent. Heat is applied to the outer casing of an apparatus, which is fully under control, so that a temperature which might injure the books can be avoided. The heat employed is from 150° to 200° F., the books being subjected to this temperature for fifteen minutes, and not injured by the process. The apparatus is said to be patented.

MORPHINE HABIT IN PARIS. — It is said that in Paris thousands of women are cutting short their careers by the use of morphine. Morphine disks are dissolved in a small bottle of water, and this is placed in a case which includes a tiny syringe. The whole apparatus is of a miniature description, and can be conveniently carried inside the smallest muff. The vice has become so fashionable that women actually fill their syringes before starting for the theatre, and thus have the means at their disposal, any moment, of injecting themselves with the drug while lounging in the *fauteuils* or in their boxes.

PASTEUR. — Pasteur and his treatment of hydrophobia — two topics which occupied the attention of the scientific world for so long a time — have hardly received even a mention of late either in the medical or the popular journals. Two of the patients treated by Pasteur for rabies have died during the present year. One of these was a boy, aged four, who was bitten by a mad dog on Dec. 6 last, and was under treatment at Pasteur's Institute from the 12th of December, 1887, until the 7th of January this year. He died of hydrophobia on Jan. 22. The second case was that of a woman, aged fifty-two. She was bitten on Jan. 23 of the present year, and was placed under Pasteur's treatment on Jan. 29. She died on Feb. 17 of hydrophobia.

ILLUMINATING-GAS. — A remonstrance largely signed by the physicians of Massachusetts has been presented to the Legislature of that State against the passage of any law allowing the manufacture of illuminating-gas containing more than ten per cent of carbonic oxide, as the intensely poisonous properties of that element of gas are well known, and are dangerous to health and life.

TYPHOID VACCINATION. — Chantemesse and Vidal communicated to the Société de Biologie some interesting observations on vaccination against typhoid-fever, claiming that in mice inoculated with cultures of typhoid bacilli a disease is produced with lesions the same as in human typhoid-fever. Mice inoculated with bouillon in which colonies have lived, but which no longer contain the bacilli, resist subsequent inoculation with the most intense typhoid virus.

ELECTRICAL SCIENCE.

Central Station Lighting.

ONE of the most interesting and important contributions to the question of alternating *versus* continuous currents for electrical distribution is the paper of Mr. Crompton, read before the English Society of Telegraph Engineers and Electricians. Mr. Crompton takes up the questions of expense of installation and of working, for two stations; one using alternating currents, the other using continuous currents and storage-batteries. The estimate for installation differs slightly from that given in a previous paper by the same author, an abstract of which was given in this journal, and enters much more into detail.

Mr. Crompton considers the cost for 10,000 lamps, to be supplied at one time from the central station. For the batteries the plan he advocates is the establishment of sub-stations where the storage-cells are to be placed. The lamp-circuits are permanently connected to the batteries, which really are more used for transforming the comparatively high potential employed than for storing the electrical energy. The batteries are of such a capacity that they can supply one-third of the energy required during the time that the maximum number of lights exceeds the capacity of the central station. If the maximum energy required is 600 kilo-watts, the central station will only have a capacity of 400 kilo-watts; the battery supplying the remaining 200 when it is needed, and being charged when the demand falls below 400 kilo-watts, the capacity of the station. It will be found, however, that this plan does not utilize the storage-battery to the full extent possible, as the central station will be idle for part of the twenty-four hours. What it does, however, is to diminish the size of the central station and equipment by one-third, and allow the electrical energy to be distributed at a high potential, by comparatively small conductors. The potential Mr. Crompton proposes to use is in the neighborhood of 450 volts, a value which seems rather low.

For the alternating system a potential of 2,000 volts is assumed, with a transformer for every one or two houses. Calculating the cost of installing the above plants, Mr. Crompton finds that the alternating system will come to £57,440; the direct system, with storage-batteries, £59,762. In calculating the running expenses it is assumed that the batteries deteriorate only fifteen per cent per year, an extremely low estimate. The following is the estimate of working expenses for a year: —

	Accumulator.	Transformer.
Materials (coal, etc.)	£2,517 0s. 0d.	£4,648 0s. 0d.
Labor and salaries	1,995 0 0	2,608 8 0
Maintenance of plant	4,086 10 0	4,683 5 0
Total	11,939 13 0	8,598 10 0
Cost per unit	3.75d	2.7d

These results, provided they were true, would be very encouraging, since they would allow electric lights to be sold at a price that would correspond to gas at seventy-five cents per thousand, with an extremely handsome percentage on the original outlay. Mr. Crompton has omitted in his estimate the cost for rent and attendance at the battery stations, — items that would add about £1,000 per year to the accumulator account, but which would still give a balance in its favor. While in this country the conditions of distribution are different, a plant of 10,000 lights being smaller than would be built in any large city, yet the comparative values given will not be greatly modified; and when we consider that here the distribution of power must be taken into account, and credited to the direct system, — power distribution being impossible at present with alternating currents, — the moral of Mr. Crompton's figures seems to be that the alternating system has no place in densely populated centres, but must be relegated to towns and the suburbs of cities, where there is a field for it as wide as its most enthusiastic disciples can wish.

ELECTRIC STREET-CARS IN BALTIMORE. — In the last few weeks a car equipped with electric motors and storage-batteries has been running in Baltimore, with a success that promises at least a systematic experiment to determine the expense and the value of the system. The condition of the street-railway tracks in Baltimore — the heavy grades and sharp curves — is such that the demand on a secondary battery is very trying; there is also a heavy demand on the motors, which must develop as much as 20-horse power for considerable distances. In order to avoid too heavy a discharge-rate from the battery, a larger number of cells are employed than would be ordinarily used. The details of the equipment are as follows: the car is a large sixteen-foot car, furnished with two Sprague motors of 7½-horse power each, capable of working up to over 10-horse power. The gearing is the ordinary gearing of the Sprague system, and has been described in this journal. The weight of the motors and gears is about 1,600 pounds. The battery consists of 126 cells placed beneath the seats, arranged in boxes of nine cells each. The cells are of the grid type, manufactured by the Accumulator Company under the patents of Faure, Sellon, Swan, etc.; the Electrical Storage Company of Baltimore having the patent rights for Maryland, the District of Columbia, and West Virginia. The cells weigh about 4,200 pounds, and the total weight of the car is 13,000 pounds. Before the car was tried, there was considerable doubt, even among members of the company, whether it would successfully take the heavy grades that the track offers. It has been running, however, for several weeks with excellent results: it ascends the steepest grades with ease, and much faster than do horse-cars; there is very little noise; the car is under most perfect control; and, as far as performance goes, it is a decided success. The question of cost has yet to be settled. If we take a number of cars, and if the street-car company supplies its own power, the cost per car per day for power will not exceed $1.75, counting all the expenses excepting only the deterioration and handling of the battery. As the cost of horse-power per car per day for the same service is not less than $6, the margin for repairs and attendance is about $4.25 per car per day. Whether that amount will suffice can only be determined by trial; but if every precaution is taken, and if the battery and motor are properly designed for the work they have to do, it is probable that the expenses will not be greater than the cost of horses. As to the increased comfort, there is no question.

SUSPENSIONS FOR GALVANOMETERS. — Dr. G. A. Liebig, in an article in the *Electrical World*, gives the results of some experiments on different kinds of silk for galvanometer suspensions. If ordinary silk fibres be used to suspend delicate astatic systems, there will be found some trouble from capricious movements of the needles. Dr. Liebig shows that these are probably due to two things. In the first place, an ordinary fibre of silk obtained from a cocoon consists of two single fibres surrounded by a "gummy substance of a gelatinous nature," the last making up about one-third the bulk of the fibre. The disturbing effects seem due to, in the first place, not separating the two parts of the double fibre; and, in the second place, to the changes in the outer gelatinous coating from moisture, etc. The remedy lies in using only a single fibre, and in washing it in hot water, dissolving off the coating. The variety of silk known as 'tussus' is especially recommended, a single fibre being able to sustain from five to seven grams, as against two grams for ordinary silk.

BOOK-REVIEWS.

Ancient Legends, Mystic Charms and Superstitions of Ireland. By LADY WILDE. Boston, Ticknor. 12°. $2.50.

THE present volume contains a great number of legends and current beliefs of Ireland, collected by an enthusiastic lover of the island and of its people. Many of the legends were directly obtained from oral communications, and the simplicity of the style in which they are told adds to their attractiveness. The contents of the volume are of great variety. A number of legends treating mainly of fairies and kindred subjects is followed by a description of festivals and myths referring to their meaning and origin. Marriage rites and mortuary customs are fully described, and in reading these we were much pleased with the author's remark that there is nothing derogatory to grief in the idea of hired mourners. "On the contrary," she says, "it is a splendid tribute to the dead to order their praises to be recited publicly before the assembled friends; while there is something indescribably impressive in the aspect of the mourning women crouched around the bier." It is this endeavor of the author to present usages, superstitions, and beliefs from the standpoint of those who hold to them, which makes the book particularly valuable, and attractive to the reader. It seems to us that the author has been eminently successful in this attempt. A special chapter treats of medical superstitions. A comparison of these remarks with Mr. Mooney's paper mentioned in a recent number of *Science* will be of interest. Legends referring to the sidhe and banshee receive special attention, while there are comparatively few treating of the saints and their exploits. The theories of the author regarding the origin of the various legends and customs occupy only a small portion of the book, and will hardly stand a severe test. The appendix, which treats principally of the antiquities of Ireland, of early Irish art and the ancient capital, — is full of enthusiasm for the early history of the country. Appended is the address of Sir William Wilde to the Anthropological Section of the British Association, delivered at Belfast, 1874.

Alden's Manifold Cyclopedia of Knowledge and Language. Vols. I.–V. New York, Alden. 12°. 50 cents per vol.

THE most striking features of the present cyclopædia are the handiness of its volumes and its cheapness, which will make it accessible to the general public. Another remarkable feature of this work is the combination of the characteristics of a cyclopædia and of a dictionary, including in its vocabulary every word which has a claim to a place in the English language. The sources from which it draws are the standard cyclopædias and dictionaries, and therefore the contents of the various titles are probably accurate. A considerable number of illustrations have been inserted in the text for illustrating the subjects treated. Considering the marvellously low price of the volumes, the printing is very satisfactory, the type being clear and sufficiently large. In selecting the titles, and in their treatment, special attention has been paid to the wants of the American public; and those who are unable to procure one of the expensive large cyclopædias will find this work useful. So far, five volumes have been issued, bringing the cyclopædia up to the word 'brave.' The work, when completed, will consist of about thirty volumes.

Practical Hints for Draughtsmen. By CHARLES WILLIAM MACCORD, New York, Wiley. 4°. $2.50.

"THE leading object of this treatise is to explain various modes of representation, which are in many cases better than the precise ones of projection." These words of the preface define clearly the scope and object of the present volume, which is of the greatest value to the student of mechanical drawing. The author is particular in emphasizing the fact that the object of the draughtsman is not to make such drawings as are correct from a theoretical point of view, but working drawings that will serve the purposes of the workman, and that the method will be best which reaches this object with the least outlay of time and labor. These principles are so sound, and their application is set forth so clearly, that the book must be recommended to all students of mechanics. The author, recognizing the difficulty of laying down the rules in which it is advisable to deviate from the laws of projection, shows in a great number of examples in which way the working drawing ought to differ from a correct projection, and emphasizes especially the necessity to omit details which are of no use to the workman. The maxim, which he advocates most strongly, that each view should be made to tell all it can, but that nothing should be put in it which does not tell something worth knowing, ought to be kept in mind by every mechanical draughtsman. A special chapter is devoted to the representation of bolts, nuts, screws, and rivets. His hints for sketching will be found eminently practical. In an appendix a description is given of drawing-instruments, intended as a guide for selecting a good set. Although we agree with the author's opinion in a general way, we cannot concur in his wholesale condemnation of instruments adapted for special purposes.

Memoranda on Poisons. By THOMAS HAWKES TANNER. 6th ed. Rev. by Henry Leffmann, M.D. Philadelphia, Blakiston. 24°. 75 cents.

TANNER'S 'Memoranda on Poisons' is so well known, that it is only necessary to call attention to the differences which exist between this and former editions. The principal changes that we notice are the substitution of modern chemical nomenclature for the older style, and the revision of the toxicology of poisonous food. Although this book is specially intended for those engaged in actual medical practice, it will be found to be a valuable addition to every library, containing as it does, in a very condensed form, the symptoms and treatment of poisoning in its many forms.

NOTES AND NEWS.

THE value of the work now doing by the United States Geological Survey will be appreciated when it is known that the engineer of the Denver and Rio Grande Railroad located its line through the passes of the Wasatch Mountains from the government maps without sending out parties to determine the best route. The engineer of the projected line from Los Angeles to Salt Lake City made similar use of the National Survey maps; and, wherever engineering-work is to be done in territory which has been covered by the survey, it has been found to be of the highest practical usefulness.

— Eight field-parties left Washington on Sunday to begin the work of the National Survey for the season on the Pacific coast. Three have gone to the gold-belt of California, under the direction of Mr. H. N. Wilson; two to the Cascade Mountains in south-western Oregon, under Mr. W. T. Griswold; and three to Montana, under Mr. J. M. Douglass. The charts they are making of California are on a scale of two miles to an inch, and those of Oregon and Montana four miles to an inch. The California parties will cover an area of about two thousand miles each during the season, and those in Oregon and Montana from three thousand to four thousand miles each. The parties that are going to south-western Oregon are to work in a region which it is believed will develop into a great gold-bearing country. It has already yielded a large amount of placer gold, but the gold-bearing quartz has not yet been developed. The survey will probably direct attention to it, and cause its rapid development. The work of the Montana parties will be about the head waters of the Missouri River, where the floods originate which cause so much damage along the lower Mississippi; and in addition to mapping the country and noting its topography, etc., they will make a special examination of the water-shed, to determine where dams can be built to hold back the destructive floods. Attention will also be given to the use of the water thus stored in irrigation. All triangulation upon the Pacific coast has to be completed early in July, before the summer haze sets in. This strange phenomenon has never been satisfactorily explained. It seems to be a mixture of smoke and dust, filling all the valleys, and rising thousands of feet into the air. It obstructs the view so that no point over five miles distant can be distinguished.

— May 1, the local committee of the American Association for the Advancement of Science, together with a number of the leading citizens of Cleveland, met in the Board of Education rooms in the Public Library Building to make arrangements for the meeting to be held in Cleveland next August. Prof. C. F. Mabery of the Case School of Applied Science took the stand as temporary chairman, and in a few preliminary remarks introduced Prof. F. W. Putnam, the permanent secretary of the association, who gave a most interesting history of the association and its objects. The officers of the local committee are: president, Cady Staley; vice-presidents, Hon. John Sherman, Hon. H. B. Payne, Pres. H. C. Haydn, Gov. J. B. Foraker, Col. John Hay, Mayor B. D. Babcock, Hon. Samuel E. Williamson, Mr. W. J. Gordon, Gen. M. D. Leggett, Mr. L. E. Holden; secretary, Elroy M. Avery, Ph.D. Committee on post-office, telegraph, and express: Prof. A. H. Tuttle, chairman; Capt. F. A. Kendall, secretary. Committee on the press: Prof. Bernadotte Perrin, chairman; Prof. A. H. Thompson, secretary. Committee on printing: C. G. Force, chairman; Dr. Elroy M. Avery, secretary. Committee on membership: Hon. C. C. Baldwin, chairman; Rev. Jabez Hall, secretary. Committee on invitations, receptions, and excursions: Mr. W. R. Warner, chairman; Newton M. Anderson, secretary. Finance committee: Mr. Solon Severance, chairman; Mr. Charles A. Post, secretary. Committee on rooms: Prof. Edward W. Morley, chairman; Prof. Herbert C. Foote, secretary. Committee on hotels and lodgings: Mr. Edward H. Fitch, chairman; Mr. Harry P. Cushing, secretary. Committee on transportation: A. J. Smith, chairman; Elroy M. Avery, secretary.

— The Texas State Geological and Scientific Association, which has for a number of years endeavored to arouse a general interest in the geological exploration of Texas, has memorialized the State Legislature, asking that it be made the agent of the State for carrying on geological work, and that a director be appointed to supervise such work. The ground which the association takes is so clear and reasonable, that it must recommend itself to the legislators. It is proposed to explore principally the deposits of minerals of economic value, and thus to give the citizens of the State that knowledge of the real value of the land they hold which they lack at present, and at the same time to develop the resources of the country. In order to make the work of such a survey as useful as possible, it is proposed to make the results known through the agency of the daily press and other publications, to be issued as rapidly as possible. It is to be hoped that the practical and wise measures proposed by the association will be carried out, as they cannot fail to benefit the people of the State.

LETTERS TO THE EDITOR.

**** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

Twenty copies of the number containing his communication will be furnished free to any correspondent on request.

The editor will be glad to publish any queries consonant with the character of the journal.

Is the Rainfall increasing on the Plains?

IN view of the recent discussion on this subject which has appeared in this periodical, perhaps it will not be amiss to add a few remarks to those of Mr. Curtis concerning the errors which may arise in climatic studies from errors in rainfall records. Rainfall records have probably been kept as long in New England as in any other part of the United States, and a number of them give indications of a secular change in the amount of rainfall. But Mr. E. B. Weston, Desmond Fitzgerald, and others who have had occasion to study some of these records, state that in certain cases the apparent change in the amount of rainfall was clearly due to the different methods pursued by different observers in measuring snow, and converting it to its equivalent in rain; and they think but little reliance can be put in the results obtained from a comparison of earlier with more recent records. Mr. Weston has also shown that gauges with different kinds of rims give persistently different results. If these early volunteer records are of uncertain value for studying climatic changes, are those which are now being gathered by our national Signal Service to prove more so? These latter records are in almost every case obtained from rain-gauges exposed on the roofs of houses; and hence the amount of rain caught becomes a function of the wind-velocity, a function of the wind-direction, and a function of other variants and variables, not least among which is a not uncommon change in the position of the gauge itself. Numerous experimental observations have shown that gauges exposed on roofs catch more rain when exposed on the side opposite to the direction from which the wind blows, and less rain when exposed on the same side from which the wind blows. The writer thought that the large errors which may arise from this source were fully recognized by the Signal Service officers and by the scientific public, so that it was unnecessary to call attention to them. But recently he has listened to two papers by well-known writers, dealing with changes in the amount of rain, especially in the West; and both these writers referred to the valuable records now being obtained by the Signal Service as furnishing a basis for future studies of this kind. The present writer inferred from these papers that the errors arising from exposure are not so fully known as they ought to be, and hence presents a brief study of the Boston rainfall record, which is only one of several similar cases which have come under his notice. For several years in succession the annual rainfall at the Boston Signal Service station has been reported below the normal According to the Bulletin of the New England Meteorological Society, in 1885 it was nearly three inches below the normal, in 1886 nearly five inches, and in 1887 nearly thirteen inches below. This seemed rather strange, since none of the numerous gauges around Boston showed such marked deficiencies. Thus, in 1887, when the Boston Signal Service station reported the annual rainfall thirteen inches below normal, the Harvard College Observatory, only three miles west of Boston, reported an annual rainfall twelve inches greater than that reported from Boston, and one inch greater than the average of twenty years' observations at the observatory. The observer at Lynn, Mass., ten miles north of Boston, reported an annual rainfall fifteen inches greater than Boston, and six inches above the average of thirteen years' observations at Lynn. According to the records of several gauges in Milton, ten miles south of Boston, the annual rainfall was from nine to twelve inches greater than at the Boston station. These stations are all so close to Boston, that it is rendered entirely improbable that there was in reality any great deficiency in the Boston rainfall; and the apparent deficiency seems clearly due to a change in the position of the Boston gauge about 1883 or 1884. Previous to this the gauge had been exposed on the roof of the Equitable Building in Boston, and these records were used in forming a series of averages or normals. Then the gauge was removed to a high tower on the Post-Office Building, and since then there has been almost a persistent deficiency of precipitation as compared with former records, or with the records of stations surrounding Boston. Moreover, the amount of rainfall caught is evidently a function of the wind-velocity, and decreases with increased velocity of the wind. Thus, during a gale on April 2, 1887, the amount of precipitation reported from the Boston Signal Service station was 0.22 of an inch; while measurements by a number of observers in and around Boston showed that snow fell to a depth of over a foot, and when melted gave an inch of precipitation as ordinarily recorded. Again, during the storm of March 11 to 14, 1888, the Boston Signal Office reported 1.24 inches of precipitation, while surrounding stations reported three inches or more.

It seems a pity that our Signal Service gauges should be so badly exposed, for these are looked to as the standards throughout the country; and there is no doubt that in the future, as in the past, there will be attempts to prove climatic changes from their records; but the writer feels that any one who has had experience with rainfall observations will look dubiously on any conclusions based on such records as exist at present. H. HELM CLAYTON.

Blue Hill Observatory, May 2.

Significance of Sex.

SOME recent publications on the subject of the significance of sexual reproduction, especially those of Dr. Weissmann (*Nature*, xxxiv. p. 629, 1886, and xxxvi. p. 607, 1887) and a short abstract of a lecture by Hatschek (*Annals and Magazine of Natural History*, i. p. 163. 1888), have induced me to draw brief attention to some speculations of my own on this subject, published several years ago.

1. Dr. Weissmann, in his admirable paper on the significance of polar globules (*Nature*, xxxvi. p. 607, 1887), after showing that there must be some very great benefits resulting from the introduction of sexual reproduction, says, "Such beneficial results will be found in the fact that sexual propagation may be regarded as *the source of individual variability, furnishing material for natural selection.*" Now, in an article on genesis of sex, published in the *Popular Science Monthly*, December, 1879 (xvi. p. 167), and republished in the *Revue Scientifique* for Feb. 14, 1880 (xviii. p. 220), the same thought is distinctly implied, though not distinctly expressed. The whole contention of the article is to show that the object of sex is the funding of individual differences in a common offspring, thereby improving the offspring; and, further, to show how much pains nature has taken to make individual sexual differences greater and greater in the history of evolution. In the last paragraph I say, "Such mixing produces more *plastic nature*, more generalized and therefore more progressive form."

This was written nearly nine years ago. Meanwhile the thought continued to develop in my mind. In a book ('Evolution and its Relation to Religious Thought') just now published, but most of which, and especially all on this subject, was written three years ago, the same thought is much more distinctly expressed. On p. 220 I say, "Why was sex introduced at all? There are doubtless sufficient reasons of many kinds, but the *fundamental reason connected with evolution is the funding of individual differences in a common offspring, thereby giving to the offspring a tendency to divergent variation.*" Again on p. 223: "*Complexity of inheritance*, like complexity of composition in chemical substances, *gives instability to the embryo and liability to variation to the offspring; and this in its turn furnishes material for selection of the fittest.*" This was written in the fall of 1884; but, being much pressed with other work at that time, I laid aside the manuscript, and only took it up again, finished it, and sent it to the publisher, about a year ago. I do not bring this forward now by way of reclamation, — for even if I had any right to make such, which I have not, I care little who brings out a truth, — but partly because I would not seem to borrow an idea without due credit, and partly because I am gratified that a thought which has lain long in my mind is now confirmed by so eminent a biologist and so profound a thinker as Dr. Weissmann.

2. There is one point, however, in Dr. Weissmann's paper, to which I would take some slight exception. He says, "There is *no essential, but only individual differences* between the nuclear substance of the spermatozoön and of the ovum. There are *no such things as male and female nuclear substances*, but only male and female cells, carriers of immortal germ plasm." Now, if by 'essential differences' he means mysterious or occult differences, such as are usually attributed to sex, he is probably right; but surely sexual reproduction is a device of nature whereby greater individual differences of nuclear substances are produced than could have been gotten in any other way. Such extreme individual differences are called 'sexual' in the case of organisms: why not also in the case of nuclear substances?

3. In the other paper referred to, Hatschek, after criticising the views of Weissmann and others, goes on to give his own theoretical opinion; viz., "that in sexual reproduction we must recognize a remedy against the action of *injurious variability*." He then goes on to show that disease or injurious variation of any kind in an individual would be indefinitely continued by non-sexual modes of reproduction, but in sexual reproduction is quickly eliminated by crossing with other strong and healthy individuals. Now, precisely this view is very distinctly brought out in my article on genesis of sex. Referring to the reasons for the introduction of sexual reproduction, I say (p. 177), "The reason is probably this: *Among all the qualities, good and bad, strong and weak, inherited (by the offspring) from both sides, there is a sort of struggle for life, and a survival of the best and strongest qualities.*" The same thought is expressed in many ways in my book on evolution, already referred to. JOSEPH LECONTE.

Berkeley, Cal., April 24.

Catching Fixed Forms of Animal Life on Transparent Media for Study.

In studying forms of animal life that become fixed to foreign bodies during their early stages of development, it is an obvious advantage to the investigator if they can be induced to attach themselves to transparent media, such as glass or mica, so that they may be studied without disturbance under the microscope with transmitted light.

Several attempts have been made to secure young oysters on glass by Prof. John A. Ryder,[1] Dr. R. Horst,[2] and Lieut. Francis C. Winslow,[3] but with only very partial success. Professor Ryder once found larvæ attached to the glass sides of an apparatus in which artificial propagation was being carried on. Dr. R. Horst tried ground and plain glass, but secured only two on the latter. Prof. Karl Möbius, in the *Zoologischer Anzeiger* of Jan. 22, 1883, describes a successful attempt to catch fixed organisms on glass. He used microscope-slides, and secured annelids, hydroids, polyps, *Bryozoa*, *Infusoria*, diatoms, etc. Prof. B. H. Van Vleck informs me that he habitually secures fixed forms of low organisms on glass microscope-slides for study.

During the summer of 1887, I was studying the development of the oyster (*O. virginiana* Lister) at Buzzard's Bay; and as I was anxious, if possible, to get them growing on glass, I tried several methods to accomplish the desired end. During my work I had very valuable assistance and suggestions from Dr. E. B. Larchar of Onset, whose disinterested aid I here acknowledge.

In a small pond-like estuary, bare at low tide, on the 14th of July, I stretched wire netting between stakes driven into the sand and raised about a foot from the sand. On this were laid panes of glass, fastened in place with clothespins. Other panes were suspended from the sides, some in the plane of motion of the incoming tide, others opposed to it. Lamp-chimneys were also suspended from the apparatus. I used some fifty panes and twelve chimneys, but met with almost total failure, securing only two oysters, one of which, however, grew to twenty-one millimetres in diameter. A few barnacles became attached to the glass.

One of the most successful spatting-grounds for oysters at Buzzard's Bay is a sand-spit exposed about four hours at low water. Here the incoming tide divides, one branch flowing to Onset, and the other to Buttermilk Bay. The force of the current is very great. On this bar, at the suggestion of Dr. Larchar, earthenware drain-pipes were partially sunk in an upright position, and loosely filled with broken glass. Six-inch and four-inch pipes were used, and at different elevations above the sand. I did not secure any spat in the four-inch pipes. A six-inch pipe sunk nearly to the level of the bar was successful, but in an unlucky day was filled up with sand, and the young oysters buried. Six-inch pipes, reaching about ten inches above the bar, were the most successful, and on the glass in them I got large numbers of young oysters. Suitable conditions for the success of the undertaking were therefore as follows: (1) a strong tide-way, which would bring plenty of free-swimming fry, and afterwards abundant food for their maintenance; (2) an area of quiet water within the pipe, in which the fry could settle and attach themselves to the smooth glass; (3) the absolute shutting-out of violent currents which would detach them from their precarious abiding-places.

I first found spat on the glass on the 25th of July, and on the 28th took out a pane 6 by 4½ inches square, on which I have just counted eighty-two young oysters, as it is still in my possession intact. This was only exceptional in the size of the glass, as other pieces bore nearly or quite as many spat proportionally to their area. Spat were secured in the pipes until the 29th of October, when few were left, large numbers having dropped off by the natural dissolving action of sea-water upon the organic cement by which they are attached.

Besides oysters, *Anomias*, *Crepidulas*, and *Bryozoa* freely attached themselves to the glass, presenting admirable opportunities for studying them alive and undisturbed.

The nature of my researches required that I should get young oysters with shells as clean and perfectly preserved as possible. In May, year-old oysters were found very beautifully preserved on the inside whorls of a dead Busycon shell, where they were completely protected from all eroding action, and clean. To imitate these conditions, in the salt-pond above referred to, I suspended a large number of two-and-a-half and three inch flower-pots inverted, from galvanized wire stretched between stakes driven firmly into the sand. The pots were raised about six inches from the sand. They met with entire success. The pots in many instances were literally almost covered with spat. On the outside of the pots very little, and on the inside no, sediment was deposited, as the pots hung like suspended bell-jars, so that the oysters were perfectly clean and very finely preserved. Further, on account of the porosity of the earthenware, the oysters had less hold than on natural cultch of stones and shells, and were easily removed for study. ROBERT T. JACKSON.

Cambridge, Mass., May 4.

[1] J. A. Ryder, On the Mode of Fixation of the Fry of the Oyster (Bull. U.S. Fish Com., ii. 1882); An Account of Experiments in Oyster-Culture, and Observations relating Thereto (Rep. U.S. Fish Com., 1882), Washington, 1884.

[2] R. Horst, On the Development of the Oyster, *O. edulis* L. (Rep. U.S. Fish Com., 1884), Washington, 1886.

[3] F. C. Winslow, Notes upon Oyster Experiments in 1883 (Bull. U.S. Fish Com., iv. 1884).

Answers.

31. BLONDE AND BRUNETTE. — A week or two ago a correspondent of yours complained of the lack of precision of meaning attached to the terms 'blonde' and 'brunette,' and the want also of words treating of intermediate shades of color as applied to the hair and complexion of Caucasian human beings. There is certainly a need of more convention on this point; for it seems strange that lower animals, and even inanimate objects (*vide* dry-goods, etc.), should be minutely characterized as regards color, whilst their lords or makers are not. It would seem as if a century and a half ago there was such better understanding about terms of color as this gentleman wishes to see established. In the *Spectator* one meets with proof of this. In one place I remember a lady (assumed) writer draws the distinction between herself and a friend in the matter of complexion as between an olive and a brunette; and the term 'a handsome black man' (to imply the latter hue in a man) is also met with in the writings of the last century. ALFRED J. HILL.

St. Paul, Minn., May 3.

BOOK-NOTES.

— D. C. Heath & Co. will publish, May 1, the second book in the series of 'Practical Lessons in the Use of English,' by Mary F. Hyde of the State Normal School, Albany, N.Y. On May 5, the same house will publish the second volume of their 'Nature Readers: Sea-side and Way-side,' by Julia McNair Wright.

— Mr. Edward Atkinson will open the *Popular Science Monthly* for June with an incisive paper on 'The Surplus Revenue.'

— F. E. Galloupe, 30 Kilby Street, Boston, proposes to publish at once an index of engineering articles contained in leading periodicals during the last five years (1883–87 inclusive), should sufficient subscriptions to the book be received.

— The Publication Agency of the Johns Hopkins University, Baltimore, announces the 'History of Co-operation in the United States,' with an introduction by Prof. Richard T. Ely, and papers by graduate students of the Johns Hopkins University on co-operation in the various sections of the country, and an index.

— The opening article of the railway series in *Scribner's Magazine* will appear in the June number, under the title 'The Building of a Railway,' by Thomas Curtis Clarke.

— Messrs. Ticknor & Co. announce for publication May 12, 'A Dictionary of Lowland Scotch,' by Charles Mackay, LL.D.; and 'The Pilgrim Republic,' an historical review of the colony of New Plymouth, by John A. Goodwin.

Calendar of Societies.

Anthropological Society, Washington.

May 1. — Mr. W. H. Holmes, Some Primitive Phases of Æsthetic Development; W. J. Hoffman, Pictography and Shamanistic Rites of the Ojibwa.

American Academy of Arts and Sciences, Boston.

May 9. — John Trowbridge, On the Present Condition of the Subject of the Photography of Color; together with an Account of Investigations at the Jefferson Physical Laboratory, on the Invisible Rays of Light.

Purdue Scientific Society, Lafayette, Ind.

April 23. — William Brady, Modes of Occurrence of Nitre; W. H. P. Creighton, Explorations in Easter Island; J. F. McBeth, Merits of the Graphic System in Static Analysis.

Engineers' Club, St. Louis.

May 2. — E. D. Meier, The Prall System of distributing Heat and Power from Central Stations.

Positions Vacant.

Inquiries from employers in want of those skilled in any department of science in its widest sense will be inserted in this column WITHOUT CHARGE.

The labor and expense involved in ascertaining what positions are open, in gratuitously advertising them and in attending to the correspondence of applicants, are incurred in the interest and for the *exclusive* benefit of *subscribers* to *Science*.

Applicants should inclose the necessary postage, for forwarding their letters.

1 — A Professor will be appointed by the Board of Visitors to the Chair of Biology and Agriculture in the University of Virginia, on the 27th of June, 1888. The emoluments of the position are $3,000 per annum and a dwelling. Inquiries may be addressed to CHAS. S. VENABLE, *Chairman of the Faculty*.

Wants.

AN EDUCATED AND CAPABLE PERSON wanted in every town and city to canvass for subscriptions to *Science*; liberal compensation. Address, naming references, PUBLISHER OF SCIENCE, 47 Lafayette Place, New York city.

SCIENCE

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SCIENCE

FRIDAY, MAY 18, 1888.

THERE IS NOW PENDING before Congress a proposition to enable the United States Geological Survey to carry on the agricultural work provided for by law. This movement was brought formally forward by the California State Grange in October, 1887. It is hardly necessary to dwell upon the desirability of collecting data as to the agricultural value of land. Work of this kind has been done in the States east of the Mississippi by State surveys and other institutions, but west of it Powell's report on the arid lands is almost the sole attempt. The work falls properly under the scope of a geological survey, as in this case it requires only little additional work to the topographical and geological surveys that are continuously going on, while under any other department it would require the organization of a new survey, and involve great expense. How much good work can be done by geologists in this line, is shown by the work of a number of State surveys, and outside the United States by the survey of Newfoundland, which carries on also the work of the land-office, and by several reports by members of the Canadian Geological Survey, who, in the maps showing the results of their reconnaissances, embody much that is of the greatest value to the farmer. As a matter of fact, the surveyors of the land-office in the United States as well as in Canada report in a general way on the character of the country, but general statements of this kind are not what is wanted. Information on the character of the land ought to be as definite as possible. If the lands were properly classified as to their agricultural, pastoral, and industrial value, the new settler would find at once the place suitable to his demands, the farmer would know how he can best develop the resources of his land, and great profit would thus accrue to the country in general. We print in another place an article by Professor Hilgard which shows the close relation between geological and agricultural conditions, and thus proves that the agricultural survey is properly a subdivision of the Geological Survey.

THE INTERNATIONAL COPYRIGHT BILL prepared by Senator Chace has been passed by the United States Senate, and it is understood that the leaders of the House of Representatives intend to give it a chance in that body before the close of the present session. This is good news to American authors, publishers, and to all classes of mechanics engaged directly or indirectly in the manufacture of books. A few English authors and some English mechanics are greatly excited over what is known as the 'manufacturing clause' of the bill, which requires that foreign books copyrighted in this country shall be immediately published here, and printed from type set up here; and the English printers have appointed a committee to secure the amendment of the bill if possible. The authors who have been loudest in their protests have been those, so says a cable-despatch to the Philadelphia *Press*, who have never had one of their books republished in this country, either with or without their consent; those whose works are popular enough to find a market in the United States being willing to submit to the extra tax which a separate edition for America subjects them to, in consideration of great advantages which the bill will confer upon them in enabling them to prevent pirating of their works in this country, and placing them in position to make terms with American publishers. The English printers and other mechanics fear, that, if the Chace bill becomes a law, many books copyrighted on both sides of the Atlantic will be printed from plates made in America, and that their business will therefore be injured. It is only necessary to say, that, without the 'manufacturing clause,' no international copyright bill would be likely to be passed by the American Congress in the next ten years. Without it, the Chace bill would not even have been considered during the present session. We hope the time will soon come when the people of both countries will see their interest in unconditional copyright in both for the literary productions of the citizens of either, and the freest competition in the manufacture of books that are read on both sides of the Atlantic. Then authors will be allowed to have their books printed in London, or New York, or Chicago, as may be most convenient or advantageous, and readers will know that they are not paying unnecessarily high prices for their reading-matter.

THE SUCCESS of the 'land in severalty' law as an agency for the civilization of the Indians depends upon many conditions, some of which are little understood by legislators, or even by the officials of the Indian service. "Cannot the government protect a man from lazy Indians who eat up his crops?" asked an intelligent member of a South-western tribe of a white man whose acquaintance he had made. A little questioning disclosed the fact that this Indian had planted ground and raised some corn. About the time the crop was ready to gather, his wife's brother arrived for a visit, and brought his whole family, and showed no inclination to go away as long as the corn lasted. His white friend asked him why he did not turn them away, but he said he could not. And this was a result of a state of society over which no individual Indian has control, but which is appreciated by very few white men. An Indian is just as much bound to share his provisions with his relatives or the members of his clan, if they desire it, as to furnish food for his children. This man saw the injustice of this, but knew no way to escape it without the help of the government. There are 'lazy Indians' in every tribe, and the industrious ones are certain to have as many visitors as they can accommodate, and the overflow will camp in the front yard. How many white farmers trying to get a start in life, even if the land was given to them, would succeed under such circumstances? Another obstacle to the success of the 'land in severalty' experiment is the natural indolence of the Indians, — an indolence that is hereditary, and the necessary result of the kind of life which the present generation and their ancestors have led. "The white man gets up and goes to work before it is light, but an Indian never wakes up until he is hungry," said a native of the Indian Territory twenty years ago; and the policy that does not recognize this fact, and seek to overcome the indolent habits rather than to destroy them by force or by placing the Indian in unequal competition with white men, is unscientific, and will certainly fail. The only hope that good will come of the severalty law, therefore, is in the execution of it with discretion, and in postponing the settlement of Indians upon lands of their own until they are prepared for it. It may be necessary, also, to protect industrious Indians from impositions by all of their own and their wives' relations.

THE SELECT COMMITTEE of the Senate of the Dominion of Canada, appointed to inquire into the value of the country north of the Saskatchewan watershed, has presented a report which is founded on a vast amount of new and valuable information. The inquiry shows that much of this region, which was considered a few years ago part of the uninhabitable polar regions, may become settled in course of time, as it possesses considerable natural resources. The great length of navigable rivers facilitates communication. The extent of continuous lake coast and river navigation is estimated at 6,500 miles, broken only in two places there situated upon the Great Slave and Athabasca Rivers. It is stated that there is a pastoral area of 860,000 square miles, arable lands to the extent of 274,000 square miles, while 400,000 square miles are considered useless for cultivation and stock-raising. The climate of this region is described as more favorable, as is generally assumed, and comparable in certain districts to that of western Ontario. It appears that there is an abundance of fish, and an ample supply of wood suitable for building-purposes. Among the mineral products, special attention is called to the extensive auriferous area and to the large petroleum-fields. The energetic attempts of Canada to develop the resources of the country have led to an increase of immigration to their western provinces. Undoubtedly the present inquiry will help to direct attention to the resources of those remote regions.

ECONOMY OF FOOD.

In February we sent out from the office of *Science* a circular letter to a number of physicians, political-economists, and others likely to be posted and interested in the economy of food. In this letter we called attention to Prof. W. O. Atwater's article on the subject in the *Century* for January, and stated that it is generally believed that even those who wish and try to economize in the purchase and use of food very often do not understand how, and that while they consult carefully the prices they pay, and judge from these the nutritive value of the articles, they are frequently misled.

Our questions sought for information as to the existence of a considerable tendency among people of moderate means to bad economy in the following respects: first, in the purchase of food either of needlessly expensive kinds or ill-balanced quantities; second, in the cooking of food; third, in the actual waste of food, that is, the throwing-away of nutritious material instead of consuming it economically; finally we asked for suggestions as to such means as might be deemed appropriate for correcting any of these forms of bad economy that might exist.

Responses were received from various portions of the country; and while the evidence was generally to the effect that there did exist a considerable tendency among people of moderate means to bad economy, there were several noteworthy opinions to the contrary.

Mr. P. H. Felker, editor of the *St. Louis Grocer*, stated that he has had an experience in the retail grocery trade, and does not think that people of moderate means exhibit bad economy, as a rule, in the purchase of expensive kinds of food. Nor does he believe that much is thrown away by poor people. His experience is, that those who pay for what they buy do not waste, but that those who do not intend to pay, but expect the world to give them a living, are careless and wasteful.

Charles N. Chapin of Providence, R.I., is another of the dissenters. He believes that there can be little question that there is a tendency to purchase needlessly expensive qualities of all kinds of food, but he is certain that there is not nearly as much extravagance absolutely among such persons as there is among the rich or even well-to-do, and he doubts very much whether there is relatively as much. According to his experience, day-laborers, workers in mills and factories, and the poorer class of mechanics, do not as a rule purchase as fine a quality of meat and groceries as do those in better circumstances. There is a large grocery in his city whose patrons are chiefly well-to-do or rich, and this grocery has never taken out an 'oleo' license; while in the stores in the poorer parts of the same city, and in the manufacturing villages, oleo is sold in large quantities, sometimes almost to the exclusion of butter. The dealer in choice groceries informs him that he sells five barrels of Haxall flour to one of St. Louis, while in the mill villages the proportion is two to one in favor of St. Louis. A butcher having some of the best trade in Providence, and also having a store in a neighboring manufacturing village, states that he sold cheaper and leaner meat in the village than in the city, yet this same man says that some of his most extravagant customers in the city were among the poor. As at this point Mr. Chapin makes an important suggestion, we quote his words: "And just here, it seems to me, is the place where an error has crept into Professor Atwater's article, and also into the report of the Massachusetts Labor Bureau. In the case above mentioned the majority of the persons who bought at the city store were rich, and those who were not were chiefly coachmen, washerwomen, janitors, and persons who were objects of charity; in other words, those who were brought into comparatively close contact with the rich, and who hence aped their manners and tastes. Such people are often the most extravagant in the world. I think it will be found that it is chiefly in neighborhoods or in stores where the rich and poor purchase together that an inordinate extravagance will be found on the part of the poor. I am positive that in our manufacturing villages and in the manufacturing sections of this city, the working-people, while requiring good food, do not consume such a high grade of goods as do those in better circumstances." In regard to the actual waste, — non-consumption of foods purchased, — Mr. Chapin holds that all evidence goes to show that the poor are much more economical than the well-to-do or the rich. In Providence the swill-contractor gets the same amount of swill from less than six thousand persons in the wealthy part of the city as he does from over twelve thousand persons in a manufacturing district; and the swill in the former case contains a large amount of nutritive material, while in the latter case it consists chiefly of bones, codfish-skins, parings from boiled potatoes, etc. Mr. Chapin believes that the use of novel or artificial articles of food, such as canned goods, oleo, glucose, cottonseed-oil, baking-powders, etc., tends to make living cheaper, while these foods are in many cases just as palatable as the more expensive. Mr. Chapin finally suggests that it is, after all, a question whether any but a very few, the very poor, need to practise much greater economy than they do. While it is true that the neck is as nutritious as a sirloin steak, it is equally true that the latter is more palatable. A man would be comfortable in patched clothes and a room with whitewashed walls and a bare floor, yet we do not consider it a sin or even unwise for the majority of even wage-earners to make their surroundings agreeable.

Mr. David Murray of the University of the State of New York has serious doubts whether the prejudice which Professor Atwater speaks of, against the purchase of cheap food, exists to any very considerable extent.

We have also to class among the doubters of the waste of food Mrs. M. Fay Peirce, New York, author of 'Co-operative Housekeeping.'

Mrs. Fay's experience is, "that Americans, especially men, crave meat three times a day; and if they can get it, they have it. No doubt," she says, "they could do with meat once a day, and make up in milk and eggs. The fact remains the same, that the human system prefers a great deal of meat; and may not the enormous energy and enterprise of the American people, and the large average of mental work which as a nation Americans accomplish, be in great measure due to the national indulgence in meat? In answer to the first question, I should therefore hesitate to say that too much meat is purchased by our people. Second, Roast meat and broiled meat are, of course, infinitely more enjoyable than boiled and stewed meats. No matter how exquisitely flavored the *ragouts*, the appetite will tire of them; but of beefsteak and mutton-chops broiled, or of roast beef and roast mutton, etc., people never tire. You cannot, however, roast or broil cheap and tough meat: hence Americans buy the roasting and broiling pieces. If they liked a savory stew as well, of course they would save their money and buy it. The simple fact is, that no art of the cook can equal the flavors of nature. Roast and broiled meat is meat *au naturel*, and, as long as the poor man can pay for it, he may be expected to indulge in it. Moreover, no doubt such meat is far more exhilarating and nourishing than boiled and stewed meats. Third, I do not believe that poor people throw away any thing they can eat. I believe that every thing they buy is eaten except the bones and the potato and squash parings; and, in general, the women who do their own cooking probably waste little if any thing. It is with the servant-keeping class that waste begins. Every servant throws away that which her mistress would save were she doing her own cooking; and the higher up in the social scale we go, the more expensive and varied the table, the more frightful is the waste. Of course, nothing can stop this but the constant supervision of the house-mistress in precisely the way that the careful German *haus-frau*, and the French middle-class woman or *bourgeoise*, keep a dragon watch over their respective cooks; and it is to be doubted whether this will ever be the case with us while American men make money so easily, and are so generous with it as hitherto. It is, of course, a perpetual slavery to the house-mistress — a tying-down to three meal-times a day — when the servant must be superintended and watched; for this must go on not only while she is preparing the food, but also while she is clearing the remnants of it away. Fourth, I have given what I consider the one and only solution, and a perfectly comprehensive one, of all the waste of contemporary housekeeping, as well as of its innumerable imperfections and shortcomings, in the theory of 'Co-operative Housekeeping.' If housekeepers never combine to keep house, i.e., to make homes in the best and cheapest manner possible, house-keeping and home-making never will and never can become to every member of the civilized human family what it can and ought to be. Meantime perhaps the best thing that could be done for the poor would be to insist on every girl of twelve or fourteen years of age who leaves the grammar-schools, learning how to make a savory stew out of cheap meat, and also how to make thick soups (what the French call *purée*) out of dried pease and beans, and also out of potatoes, onions, celery, spinach, etc. I know that poor women constantly wash and sew for a living, and bring up their children on tea and bread chiefly. Of course these are cheaper at the moment, and easier, than even a cheap meat-stew; for cheap tea is certainly a very cheap way of getting motive power to work, probably the cheapest there is. But if poor women knew how to make a cheap stew that is really appetizing and satisfying, perhaps they would more often do it."

Prof. J. B. Clark of Northampton, Mass., agrees that the poor, in common with other classes, depart from the rule of a maximum of nutriment for a given sum; but the departure is, in his opinion, rather beneficial than otherwise. If any class in America above the very lowest were to consume as much food as they now do, and were to select the kinds that offer the largest amount of nutriment for the money, they would suffer from the worst physiological effects of over-eating. There is, however, a general habit of consuming too much sugar for either health or economy, and of using unnecessarily expensive grades of flour and meat.

Prof. Edward W. Bemis of Vanderbilt University, Nashville, Tenn., agrees with Professor Atwater as to the great wastefulness almost everywhere prevalent in this country, but to the list of reasons assigned by him, would add another as also operative in considerable measure in the case of the average wage-earner. As he writes, "it is generally believed by the latter that wages tend to fall toward the customary cost of living, to that point which will sustain a given class of workers in their usual comforts; and that, in consequence of this, any denial of one's taste which is involved in the use of the cheaper and more nutritious, but even, according to Professor Atwater, less palatable foods, will only result in the end, if generally adopted, in lower wages. To establish this dependence of wages on average expenditures is the sole aim of George Gunton's recent book, 'Wealth and Progress.' At one time the reasoning on which the above book and the general belief of our workingmen are founded seemed conclusive to the writer, and the presentation of the argument, as it then appeared to me, drew out, in private conversation with a prominent writer and advocate of Professor Atwater's views, the candid admission that 'perhaps, after all, the great benefit of this more scientific choice and preparation of food will consist in prevention of dyspepsia,' — one of the few ailments from which the poor are comparatively free. He was right, provided the theory of wages just quoted — which, be it noted, is quite a modification of the so-called 'iron law' — is correct. This I do not believe; that is, it seems to be true only with this important change, — that wages tend to fall to that point which will maintain the workman in his usual comfort, and permit of his usual savings; the latter, it is true, being now small or non-existent, and both the standard of comfort and savings being subject to fall in times of long-continued industrial depression or cut-throat competition from the unemployed or from immigrants used to a lower standard of living, but also (and this is most important) being subjected to great and general increase with education and enlargement of social wants. Money saved by the use of cheaper and equally nutritious food may be invested in banks and co-operative building and loan associations, called in Massachusetts 'co-operative banks,' and wages be still maintained at the old rates: for the money saved will become the capital of its borrowers, and thus increase competition for labor. This is no place for a full discussion of the subject, though one's theory of wages is the perhaps unconscious basis of nearly all discussion of economy of food as applied to the elevation of the masses, in which aspect Professor Atwater's ideas attain their widest importance. If wages may be kept as much above one's standard of living, after allowing for the rewards of the capitalist and employer, as the general thrift, intelligence, and power of combination of the workmen may secure, and not necessarily fall with the use of less expensive and equally nutritious diet (as most wage-earners, both in and out of the unions, believe), then the present widespread and natural objection of the masses to the views of Professor Atwater will be fully met." Professor Bemis therefore urges, first, a far deeper study of the theories of wages, and a far wider dissemination of correct views on the subject among the masses, as a necessary preliminary to instruction upon the direct question of food-supply.

The opinion of the majority of the replies is well given by Mr. F. E. Manson of the *Kennebec Journal*, Augusta, Me., who writes, "I have observed, even among the employees of our own establishment, the tendency to bad economy, especially in early spring, when food-articles first coming upon the market are sold at outrageous prices. Again: the purchases made the year through at the provision-stores show the tendency toward luxury instead of healthful and strength-giving food. There is no doubt in my mind that there is a vast diminution of the real fuel-properties of food in the way it is cooked by the very people who most need its every strength-giving property. One has simply to sit down at a table to evidence this. There is here a cause of the very condition ('of moderate means') of our people. To make the most of food-articles is yet a lesson to be learned. Generally among our people an article of food once cooked is considered done. The parts not eaten are wasted; whereas if the parts had been separated before cooking, and cooked in different ways, or separated after cooking and re-served in a different form, all the nutritious properties would have been consumed, and economy practised."

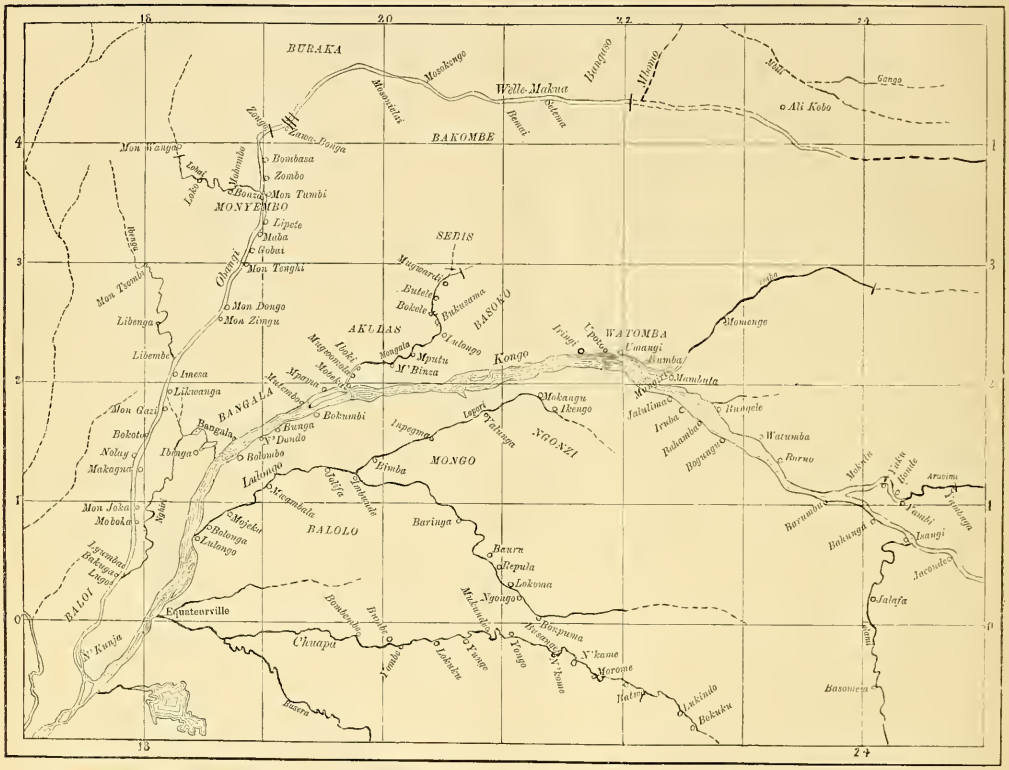
In reply to one inquiry, Gen. F. A. Walker of Boston writes, "Among people of moderate means in the United States there unquestionably is great waste, resulting alike from indifference and from ignorance; but among the very poor the waste is simply hideous. Cheated often in quantity, quality, and price at the retail stores, the great majority of the women of the poorest class, who are generally foreigners, are altogether incapable of managing what they get for their scanty incomes, with true economy. They lose in storing their supplies, in cooking them, in serving them. Even this is not so bad as the injury done to health and to personal habits (through the promotion of intemperance) by frying food, by the use of saleratus, and by the bad management of fires during the process of cooking. Much can be done by the intelligent and benevolent to promote a better economy of the small means of the very poor, through lectures, newspaper paragraphs, and house-visiting. But it is with the cooking-school that the hope of a better generation of housekeepers and domestic cooks chiefly lies. The economy of food and materials here secured is quite as remarkable as the superiority of results in wholesome, cleanly, appetizing food. On the former point let me cite a single instance. At the Tennyson Street School, in Boston, the amount of coal consumed during the first nine weeks of the present school-year, in keeping the range ready to cook, from half-past nine to four o'clock each day, five days in the week, was only one-quarter of a ton. No one can visit the school to which I have referred without being impressed by the truly and highly educational character of the teaching given, as well as by the immense practical value of what is learned. And there is this notable difference between the 'book-learning' in the public schools and the instruction in cooking and sewing given in them; viz., that while the former does good to the children only, and leaves the parents where their own schooling (if any) left them, the domestic arts taught are at once carried home, and become a speedy and efficient means of improving, if not of transforming, the household. Believing, as I seriously do, that the chief cause of that destructive appetite for strong drink, which we once deemed native and ineradicable in the human constitution, is found in unsanitary conditions, especially in badly cooked and improperly prepared food, I look on the public cooking-school as, in a high sense, the hope of the Republic. I believe that a given effort and expenditure directed to this point will accomplish a hundred times more towards eradicating intemperance than the same amount of effort and expenditure directed against the drinking-habit, when once formed."

Prof. William H. Brewer of New Haven answers in the affirmative to each and all of the queries. He believes there is waste, "partly through ignorance, partly because of prejudices against particular kinds of food, partly because of mistaken social notions, and divers other causes. Cooking is an art, and careless cooking causes much waste directly, and indirectly prevents much being made available that is now about wasted." As a member of the Board of Health, Professor Brewer has looked into the matter of kitchen garbage in several cities, and so has means of knowing that people of moderate means do throw away a great deal of nutritious material instead of consuming it economically. He thinks such bad economy can only be bettered by education and the diffusion of knowledge, especially of those kinds of sciences which are more immediately pertinent.

EXPLORATION OF THE OBANGI-WELLE.

THE incessant endeavors of the Kongo Free State to ascertain the supposed identity of the Obangi and Welle have at last been successful. The last issue of the *Mouvement Géographique* gives a sketch of the result of the last expedition, which was under the command of Captain van Gèle. The sketch-map below shows the results of this exploration.

On Oct. 26, 1887, the expedition started from Equateurville on board the steamer 'En Avant,' which had a large canoe from Stanley Falls, capable of holding a hundred men, in tow. The party consisted of Captain van Gèle, Lieutenant Liénart, the captain of the steamer, a carpenter, seventeen soldiers, and twenty-four natives. On Nov. 21 the rapids of Zongo were reached, which stopped Grenfell's progress on his reconnaissance in 1884, and Van Gèle in 1886. Here a succession of rapids was met with, which it took twenty days to pass. The steamer was unable to pass the first rapids, although it was at the season of high water. The machinery had to be taken out, and was carried over a portage. The steamer was then drawn by a tow rope up the rapids, and was remounted. For eighteen miles her progress was not hindered by any obstacles, but then the rapids of Bonga were reached. These consist of a reef, crossing the whole width of the river, and leaving only a narrow channel near the southern bank, through which the steamer passed without any difficulty. After a short while a new rapid was reached. Here the Obangi narrows to a width of fifteen hundred feet, while it attains a depth of fifty feet. These narrows were hardly passed, when the river was found to expand to sixty-five hundred feet in width. It is studded with rocky islands, between which the waters rushed towards the narrows, boiling and foaming. The steamer was unloaded, and the cargo carried over a portage.



THE UPPER KONGO AND THE BASIN OF THE OBANGI-WELLE, SHOWING THE DISCOVERIES OF CAPTAIN VAN GÈLE.

Thus she was enabled to ascend the rapids. Three miles farther up the river another rapid similar to the last was found, and ascended in the same way. The next obstacle was by far the most formidable one. Several islands situated in the river are connected with the banks by rocks, over which the river falls. Here the 'En Avant' had to be unmounted and unloaded, and the hull was hauled up the fall with great difficulty. Captain van Gèle describes this region as follows: —

"The country is beautiful. The banks of the river are bordered by hills of gentle slope, with woods and prairies, plantations of bananas, and fields of maize. Most of the villages are situated on the slopes of the hills. Seen from afar, the huts give the impression of Swiss cottages. If there were herds of cattle grazing on the prairies, the illusion would be complete. The country seems to be of great fertility, the grass attaining in some places a height of twenty feet.

"The fronts of the villages situated on the banks of the river are fortified by stockades. On high trees of cottonwood, guards are stationed in rudely constructed huts, which have given rise to the legend of aerial villages. I have not seen any manioc or palms in this district, while bananas, sugar-cane, and maize abound. Up to the third rapid the natives are of the same type as those living farther south on the river. Their heads are shaved, and their heavy mustaches give them a military air. Their faces are not tattooed. We were very kindly received by this people. Above the third rapid a new tribe was met with, — the Bakombe, who are said to occupy a great part of the territory between the Obangi and Kongo. They have a very remarkable fashion of dressing their hair. Some wear enormous chignons; others, forms similar to those worn by the Mombuttu; still others, long and slender tresses, sometimes as long as six feet."

At the last rapid the waters of the river come from the northeast. The view is grand. The river is about twenty-eight hundred feet wide, and free from obstacles. Farther east its course was found to be westerly. No tributaries were discovered above the rapids. On the northern bank the country is level, while in the south a few low hills may be seen. Although not a single house is seen from the steamer, the country is densely inhabited, numerous villages being situated a few hundred steps distant from the banks of the river. The latter are called 'Dua' by the natives. There are numerous islands, most of which are inhabited and cultivated. Captain van Gèle states that the country is one of great fertility, and that more provisions were offered him than his party was able to consume. Beautiful work in iron is made by the natives, while ivory seems to be little valued. It is worth remarking, however, that it is used for labrets worn in the upper lips.

At Bemay a new rapid was met, which, however, was passed by the help of the natives. A few miles above Setema, the first tributary, the Bangaso, was seen. It is a remarkable fact that neither on the north nor on the south side are there any tributaries. The same scarceness of tributaries is observed on the Kongo: therefore it seems probable that the region between the Shari and the Chuapa is throughout occupied by rivers running east and west. After the Bangaso was passed, a new tribe was met, the Yakoma, who attacked the steamer. On Jan. 1, 1888, the 'En Avant,' which steamed along the north bank of the river, met a line of rocks forming a rapid. The steamer separated from the canoe in order to search for a pass. Immediately numerous natives attacked the canoe. At the same time the steamer struck a rock, and it was necessary to unload and to make a landing among the hostile natives. Lieutenant Liénart, who was charged with this task, was kindly received, but only to be attacked the more vigorously later on. In the ensuing struggle two of his men were killed. After all, the steamer was reloaded and repaired on an island; but the hostility of the natives, and the fact that the water of the river was falling rapidly, made it necessary to return at once. The expedition had reached 21° 55′ of longitude, the distance to the farthest point of Junker being some seventy miles. It is in this unknown stretch that the Mbomo empties itself. The return was effected without casualties.

The important result of this expedition is to show that the Welle belongs to the Kongo system; for it would be unreasonable to doubt its identity with the Obangi any longer. There is also some prospect of having the western boundary of the Kongo basin explored ere long. Two German expeditions are pushing eastward from Kameroons, while the English missionary Brooke is ascending the Obangi, intending to strike north-westward from Zongo.

SCIENTIFIC NEWS IN WASHINGTON.

The Work of the United States Fish Commission on the Atlantic Coast; the Migrations of Fishes governed by the Temperature of the Water; Isothermals to be constructed. — A Great Work by the Bureau of Ethnology; the Dictionary of North American Indian Tribes completed. — Shall the Arid Lands be reclaimed? a Magnificent Undertaking. — A New Law for the United States Fish Commission proposed.

The Work of the 'Grampus.'

ONE important fact has been established by the investigations of the United States Fish Commission, and that is, that the movements of the great masses of food-fishes that visit the bays and rivers of this country in summer are not governed by a desire to return to the localities where they were born, nor by the scarcity or abundance of food, but by the temperature of the water in which it is suitable for them to spawn. For instance: the shad never enter one of our bays or rivers in the spring until its temperature has become 60° F. Then they pass into the rivers, and up towards their sources, always seeking the warmer waters. They move up stream when the difference of temperature is so slight that it can only be detected by the use of a differential thermometer; but so sensitive are they with their whole bodies immersed, that they easily discover the direction in which the warmer water lies.

The reason why the attempt to plant shad on the Pacific coast failed is now known. Large quantities of little shad were planted by the United States Fish Commission in the Sacramento River. Very few of them returned, and all the attempts to stock the Pacific coast waters with shad have resulted only in distributing the fish in small numbers along the coast to Vancouver's Island, a distance of sixteen hundred miles. A few now enter the small rivers that have their sources near the coast, but nowhere do they show a disposition to come in great bodies, as on the Atlantic coast. The explanation is, that the bay is fed by rivers rising in the mountains, and bringing down melted-snow water, so that its temperature during the spawning-season for shad is only 55° or 60°. Fishes that were placed in the Sacramento River one year, therefore, never come back. If they approach the bay, they find it too cold to pass.

California salmon, on the other hand, require a temperature of from 40° to 45° for spawning. As they go up the rivers from the Pacific Ocean, the water becomes colder, and they finally reach that which is just right. But young California salmon placed in Eastern rivers do not become acclimated; in fact, they rarely come back. Of fifteen million young ones so planted by the United States Fish Commission, not more than three or four have ever been caught or seen in the rivers it was desired to stock. The water of the rivers is warmer as they go up stream, and they avoid it. The attempt to stock the rivers of southern Europe flowing into the Mediterranean Sea with California salmon has been successful for two reasons: they have not been able to get out of the Mediterranean and find other spawning-places if they desired; and they have found streams which, being fed by melting snows in the mountains, furnish the conditions sought.

Menhaden never enter rivers the temperature of which is below 50°. These fishes visited the coast of Maine in great numbers for forty years, but in 1878 suddenly disappeared. The same year the mackerel did not enter the Bay of Fundy. It is now believed that this strange phenomenon was caused by a change in the temperature of the water.

These facts being established, it becomes very important, from an economic point of view, to ascertain what changes take place during the season in the temperature of the ocean off our coast and of the bays enclosed by it, to plot isothermals, and to lay down upon charts the migrations of these isothermals as the season advances. It is believed, that, when this is done, the migrations of our summer food-fishes will also be discovered, and that their movements can be accurately predicted. This work has been assigned to the 'Grampus' for the present season. Her field will be from the capes of Virginia north. She will make careful observations of the temperature of the surface and bottom of the water, and try to plot the isothermals of 50°, 55°, 60°, 65°, and 70°. The reports of a vast number of former observations made with other ends in view, but which included temperatures, are now being examined in Washington, and the results plotted upon charts; so that the amount of data available for constructing the isothermals will, by the end of the season, be very large.

Another duty assigned to the party in the 'Grampus' is to discover, if possible, the spawning-grounds of the bluefish and mackerel. To this end the great masses of floating fish-eggs found upon the ocean at certain seasons will be examined for the purpose of determining what they are. Small hatching-apparatus have been supplied; and samples of the eggs will be hatched, and the young developed sufficiently to enable the embryologists to determine what they are. This work, if it is successful, is also expected to be of great economic value. In order for Congress to be able to legislate intelligently for the protection of food-fishes, it is necessary that their habits should be understood. If the mackerel and bluefish, for instance, spawn out at sea, where there is no danger that they will be disturbed by fishermen, it will be unnecessary to make laws restricting the capture of them on the grounds where they are usually taken. It is not probable that the capture of these fish for food or other purposes makes any perceptible difference in their numbers, unless they are stopped on the way to their spawning-grounds.

Dictionary of North American Indian Tribes.

The Bureau of Ethnology has substantially completed the dictionary of North American Indian tribes, upon the preparation of which it has been engaged for many years; and it is probable that the work, comprising a volume of about five hundred pages, will be published within a year. For practical as well as scientific uses, this will be the most important product of the bureau since its organization; except, perhaps, the map showing the geographical distribution of the linguistic families of Indians, a notice of which was recently given in *Science*. The material is now in the form of cards alphabetically arranged. Each card contains one title, and of these there are between forty thousand and fifty thousand.

The plan of the work is to give alphabetically the name of each linguistic family, tribe, and village of the North American Indians at the time of the settlement by Europeans, with all the known synonymes for them. The work has involved the long and patient labor of a great number of specialists under the direction of Prof. H. N. Henshaw, and could not possibly have been undertaken by a private individual.

A word as to the method of preparation. The literature of the North American Indians is very voluminous. Early and later explorers, travellers, missionaries, traders, pioneer settlers, and soldiers have written about them, or have referred to them in their books. Very rarely have they been careful to be exact in the spelling of the names of the tribes they have described; and, when they have done so, typographic errors have crept in, which have been perpetuated and often added to by other writers, until the synonymes have been multiplied almost without end. For example: the number of different names and different spellings of the same name found in literature to designate the Mohawk tribe is about two hundred. The most of these would not be recognized by the ordinary reader, and many of them not even by the student of Indian ethnology. In fact, even the scientific man can hardly read five pages of an old book on the North American Indians without encountering the name of an Indian tribe that he never heard of.

Many writers have misunderstood the names the Indians gave them; others, thinking from the form of the name as they have found it in some book that it must be incorrect, have guessed at what it ought to be, and have generally corrupted it still more; still further variations have been caused by typographic errors, as has already been noted, until there was almost inextricable confusion. For instance: one writer speaks of the 'Roundaxes' Indians; an earlier one, of the 'Rondaxes;' one still earlier, of the 'Orondacks;' and the true name is the 'Adirondacks.' In another case the 'Round Head' Indians are mentioned; a French book, which was probably this author's authority, calls the same tribe the 'Tête de Boule;' he probably got the name from an English writer who had spoken of them as 'Bullet Heads;' their true names was 'Bull Heads.' In still another instance the reader encounters the name 'Pickpocket' to designate a tribe. This came from 'Pickwocket,' which was itself a corruption of 'Pigwolket,' which somebody wrote for 'Pigwacket.' The last writer misunderstood the true name 'Pâgwâki.' The following is very funny: The 'Kouani' tribe are first called 'Kuhus,' then 'Ku-un,' then 'Kun' (pronounced 'Coon'), and then 'Raccoon.' The 'Sundowns' of a certain author are the 'Samdans.'

By a careful examination of the literature of the North American Indians, all these names have been collected and arranged, first under the linguistic families, and then according to tribes. When thus brought together, the origin and relations of the different synonymes have been discovered, although previously they were not at all apparent.

In the dictionary the name of each linguistic family will be given in its proper alphabetical place, followed by a short history of each, a description of it and of the country it inhabited, and a list of the tribes that composed it, and of the villages in which they lived. The name of each tribe will be found in its proper place, with a list of all the synonymes for it; each of which, in turn, will be entered in alphabetical order with a cross-reference to the correct name of the tribe, a statement of the linguistic family to which it belongs, and a list of the villages it occupied. Finally, the name of each village will be entered, followed by a brief description and a statement of the tribe and linguistic family of its people, and the number of its inhabitants.

The publication of this dictionary will make intelligible much in the literature of the North American Indians that has heretofore been vague and confused; it will enable the reader of books referring to them to identify the tribes and villages; it will simplify the labors of investigators in all other branches of Indian ethnological research. For example: a great number of skulls have been collected at the National Museum, where they are classified and arranged for study. The collectors are many of them army officers, Indian agents, and voluntary contributors, not special students of ethnology, who have given the names of the tribes represented as they have heard or understood them. The dictionary will enable the curators to identify these tribes, and thus make the classification easy. Dr. Yarrow of the Army Medical Museum is preparing a book on the mortuary customs of the Indians. Until this dictionary is published, or he has access to it in its present form, no thorough classification can be made. The dictionary will also enable the government to determine the boundaries of lands ceded by Indian tribes, and in many other ways clear up doubtful and disputed questions.

Reclamation of Arid Lands.

Congress has been asked for an appropriation of two hundred and fifty thousand dollars to pay for the preliminary work of damming up the cañons of the Rocky Mountains, from the Dominion line to Mexico, and thus forming vast reservoirs of water to be used in the irrigation of arid lands, and preventing the disastrous floods on the lower Mississippi. The area of arid land in the United States is about 1,300,000 square miles; and Major Powell, director of the National Survey, estimates that at least 150,000 square miles of this might be reclaimed, — a territory exceeding in extent one-half of all the land now cultivated in the United States. The plan is to build dams across all the cañons in the mountains, large enough and strong enough to hold back the floods from heavy rains and melting snows, and then to let the water down, as it may be needed, upon the lands that would be reclaimed.

The preliminary work for which the appropriation is asked is to pay for surveys to determine the sites and locations for the dams, reservoirs, canals, and irrigation areas; the total volume of water susceptible of storage, and the loss through evaporation and seepage in the reservoirs and canals; the area of land to be served by a unit of water; the value of the redeemed land for the growth of the crops adapted to the climate and soil; the expense of constructing the dams and canals and the expense of maintaining them; what vested rights, if any, exist.

With ample appropriations, at least two years will be required for this preliminary work. Major Powell, who has probably studied the Rocky Mountain and arid region more carefully than any one else, declares that the scheme is a perfectly feasible one, and that the cost, though very great, will be but a small fraction of the value of the land reclaimed. While the western portion of the United States is not yet crowded when compared with Europe, or even with other parts of our own country, it is no longer true that "Uncle Sam is rich enough to give us all a farm." But, if 150,000 square miles of the arid lands of the United States could be reclaimed, the limits of our agricultural development would be enormously extended.

Re-organization of the United States Fish Commission.

The bill prepared by Professor McDonald, and introduced in the House of Representatives, to re-organize the United States Fish Commission and to define its duties, declares "that it shall be the duty of the commissioner of fish and fisheries to continue the systematic investigation of waters of the United States, and of the biological and physical problems they present, with the object of determining the character, abundance, geographical distribution, and economic value of the inhabitants of the waters, both salt and fresh, as also their migrations, and the cause influencing or regulating the same. This investigation is to be conducted on a broad and comprehensive plan, so as to arrive at the life-history of all species having economic value, as well as those species to which they are intimately and essentially related.

"That he will continue the investigation into the history of the methods and apparatus of the fisheries and for the preservation and utilization of fishery products now in use, and will cause careful study to be made of new methods and apparatus introduced from time to time with the object of determining their effect upon production, and furnishing the information upon which to frame intelligent legislation regulating the conduct of the fisheries and improving their methods and apparatus.

"That it shall be the duty of the commissioner of fish and fisheries to provide for the collection of the statistics of the fisheries of the United States, especial reference being had to the fisheries of the Great Lakes and of the New England and North Pacific coasts of the United States, which are of international importance, and may influence or become the subject of treaty stipulations. The statistical inquiry hereby authorized and directed shall be comprehensively planned to accomplish the purposes for which it is instituted.

"That it shall be the duty of the commissioner of fish and fisheries to continue the work of artificial propagation of food-fishes and other useful inhabitants of the water with a view to their introduction into and establishment in the interior and coast waters, and to the maintenance and improvement of the important commercial fisheries of the coast and interior lakes and rivers. To this end he will, in his annual estimates transmitted to Congress, provide for the maintenance and operation of the existing stations of the commission, and for the maintenance and operation of such additional permanent and field stations as may be from time to time authorized and directed.

"That the commissioner of fish and fisheries shall appoint such employees as Congress may from time to time provide, with salaries corresponding to those of similar officers in other departments of the government, and he shall, as Congress may from time to time provide, employ other persons, of expert knowledge, for such time as their services may be needed, including chemists, naturalists, and physicists, for the conduct of the researches and investigations required in the performance of the duties devolved upon this department, or which may be from time to time authorized and directed by Congress."

HEALTH MATTERS.

Contagion in Courts. — The State analyst of New Jersey, in a recent trial, when called upon to take an oath as witness, avoided kissing the Bible on the ground that he might contract disease by so doing, saying, "So many different persons have kissed that book, that I do not think it safe to touch my lips to it." The court held that the witness must kiss the book, and he reluctantly did so. This seems like a trifling matter, and yet it might be a serious one. The danger of contracting disease in this way is not imaginary. Until courts so disinfect the Bible on which oaths are taken as to make the act of kissing it safe, we would advise the practising of a device which the writer has for years employed; viz., to kiss the fingers with which he holds the book.

Educating the White Blood-Corpuscles. — Dr. Ray Lankester, in an address on 'The Struggle for Life' (*The Hospital Gazette*), in speaking of the function of the blood-corpuscles, said that the corpuscles could be educated to deal with the bacteria, and the future of preventive medicine would be the education of the white blood-corpuscles. The fact that one man, by constant use, could without injury take a dose of arsenic that would kill six ordinary men, was due to the fact that he had by weakened doses been educating and training the white corpuscles. They could be taught to eat and flourish under conditions which, if not commenced gradually, would be destructive to them, and that was the principle underlying protective inoculation. As a preventive of many fatal diseases in sheep and oxen, inoculation had been remarkably successful. The corpuscles first received a weakened breed of disease by inoculation, and thus when a violent attack came they were ready to receive and dispose of it. This education of the corpuscles, it seemed to him, was the explanation of the success of vaccination. They received a weak dose of the poison from the vaccine, and were in that way prepared for a stronger dose in the way of small-pox. He believed the white corpuscles could be trained to receive the most virulent poisons, and he hoped this training would be carried on so as to deal with a great number of diseases.

ELECTRICAL SCIENCE.

Sir William Thomson's Electrical Measuring-Instruments.

For some years past Sir William Thomson has been working on electrical measuring-instruments with a view to perfecting some means of accurately and easily measuring the heavy currents and the potentials used in commercial work. Mr. J. A. Fleming, in *Industries*, describes the latest forms Sir William has produced. The ammeters are six in number. The different types are, —

The Centi-ampère	balance	from	1	to	50	centi-ampères
" Deci-ampère	"	"	1	"	50	deci-ampères
" Ampère	"	"	½	"	25	ampères
" Deka-ampère	"	"	2	"	100	"
" Hekto-ampère	"	"	10	"	500	"
" Kilo-ampère	"	"	50	"	2,500	"

All of these instruments are on the same general plan. The attraction between two coils carrying the current — one movable, the other fixed — is balanced by a weight sliding on a scale-beam. Heretofore the difficulty in such an arrangement has been in getting heavy currents to the movable coil without greatly decreasing the sensitiveness of the apparatus. In these instruments there are two movable coils, fastened on the two ends of a light frame, and below each of them is a fixed coil. The frame has an axle in the middle by which it is suspended, and it is in the suspension that the chief novelty and improvement lie. The axle ends in two semi-cylindrical trunnions. Above them are two similar fixed trunnions. The two sets are connected by a number of extremely fine copper wires bearing on the rounded surfaces of the lower trunnions. This arrangement allows a free though limited movement of the frame, and the numerous fine wires will carry a heavy current. The winding of the two coils are such that one end of the frame is repelled, the other attracted, when a current passes. There is a scale-beam attached to the frame, and a weight moving on this is shifted until the frame is horizontal. The reading on the beam opposite the weight gives the current that is flowing. The great advantage of this arrangement, as in other forms of electro-dynamometer, lies in the fact that the readings are independent of any change in the strength of magnets, such as are used in ordinary commercial measuring-instruments, and also of the value of the earth's magnetism. The instruments, however, are not so portable as many other forms, and are somewhat difficult to adjust. They will be useful for standardizing the ordinary forms of voltmeter and ammeter.

Elongation and Contraction of Metals in Magnetic Fields. — The first experiments made by Joule on the effect of magnetization on the length of iron showed that the iron always elongated. Mr. Bidwell has investigated the effects of very much more intense magnetic forces than were used by Joule. At first the iron expanded, but, after reaching a magnetic force of about 90 C.G.S. units, the iron began to contract, reaching its original length at about 280 C.G.S. units, and contracting continuously until the force reached 800 C.G.S. units, the limit of the experiment. Cobalt, nickel, manganese, steel, and bismuth were also experimented on. The two latter were practically uninfluenced in length by the application of any magnetic force. Nickel and cobalt began to contract from the first: nickel continued to contract to the limit of the experiment; cobalt contracted until the value of the force was about 400 C.G.S. units, when it expanded again; not, however, reaching its original value at a force of 800 C.G.S. units.

A New Alternating-Current Electro-Motor. — Patents have recently been issued to Nickola Tesla for an alternating-current transformer and a motor which embody some novel features. The motor is especially interesting: it is really a modification of a plan proposed by Prof. Elihu Thomson, although the arrangement is different. The armature consists of two coils wound at right angles to each other on an iron core. The coils are short-circuited on themselves, and are not in any way connected with the external circuit of the dynamo supplying the current. The field-magnet consists of an iron ring, the four quadrants being wound with coils, of which the two opposite are connected. The dynamo used to supply the currents has two sets of coils, giving alternating currents of exactly opposite phases. These currents are taken to the motor by separate circuits, and are connected to alternate quadrants of the field-magnet. The action of the motor consists in inducing, by the alternating currents in the field, currents in the closed circuit armature coils, and in alternately attracting and repelling the coils. This motor, then, has no commutator nor brushes, and, if it works, will be the simplest possible means of transforming energy. As to the efficiency and output of this motor, we will have more to say later.

Heating Effect of Electric Currents. — M. Cailletet has experimented on the heating of wires by an electric current when the pressure of the air around the wire is increased. He finds that the heating effect is decreased as the pressure increases. A current that would fuse a wire under ordinary pressures, will only raise it to a dull redness when the pressure is increased. This shows the importance of convection in incandescent lamps, and the desirability of the highest attainable vacuum.

Variation of Co-efficients of Induction. — Mr. W. E. Sumpner has experimented on the co-efficients of self-induction of transformers under various conditions. He finds that the co-efficient varies greatly with different conditions of current, etc., and plots curves representing the values for different currents, defining the co-efficient as the rate at which magnetism changes with the current. The results of Mr. Sumpner's work show, perhaps, for the first time, the very great variation in a co-efficient that has been taken as constant in a large number of solutions of problems bearing on the subject of alternating currents. In this connection a series of papers on induction-coils, that is now being published in the *Electrical World*, is important. Heretofore the subject of alternating currents has not been experimented upon in a way to show whether the assumptions that have been made are approximately correct. These 'Experiments on Induction-Coils' show that many of the solutions that have been given are altogether wrong. So far, however, the most important papers of the series have not been published: their appearance is awaited with interest.

New Method of reading Reflecting-Instruments. — The following is an abstract from a paper by M. F. Drouin, in the *Lumière Electrique*: "The usual mirror is replaced by a thin disk of glass. The scale being behind the instrument, the observer in front sees the scale directly through the glass; while he sees reflected from the front surface of the glass the image of an object, such as a black line on a white background, placed in front of the instrument and to one side. When the glass disk is deflected through an angle a, the virtual image of the mark is displaced through a distance d. tan $2a$ (d=distance from glass to scale). The method can be used in a well-lighted room, and does away with all the trouble of lamps and shades."

BOOK-REVIEWS.

Tenth Annual Report of the Connecticut State Board of Health for the Year ending Nov. 1, 1887, *with the Registration Report for* 1886. New Haven, State.

In addition to the usual official reports and tables of vital statistics, this volume contains a report on river-pollution by Prof. S. W. Williston, M.D., Ph.D., with reports on water-analyses by Prof. H. E. Smith, M.D., and William G. Daggett, M.D. This report is a very valuable and thorough one, and covers nearly one hundred pages. It is the outcome of an act of the Legislature authorizing the State board to investigate and ascertain, as far as practicable, all facts in relation to the pollution of streams and natural waters of the State by artificial causes, in order to determine the sanitary and economic effects of such pollution. In the report are described the chemical processes employed in the manufacture of brass, iron, paper, woollen, cotton, and silk goods, hats, and rubber goods, and the impurities which are cast into the streams of the State from these manufactories. In the analyses of the water, both the biological and chemical methods were employed.

The annual report also contains reports on an epidemic of dysentery in Thomaston, by R. S. Goodwin, M.D. In this report the author presents the following conclusions as a result of his study of the epidemic: "that the outbreak of dysentery at Thomaston, and at every other town on the Naugatuck River, occurred in consequence of the co-operation of several favorable influences. These were a certain season, a certain high temperature, a certain favorable location, unsanitary modes of living, and the use of impure drinking-water. Nevertheless, infection with a certain specific poison was the sole cause of this disease, and the *rôle* played by these influences in its etiology was only to increase the predisposition to the affection by rendering the human organism more sensitive to the action of this unknown poison."

Dr. C. W. S. Frost contributes a sanitary report of the city of Waterbury, from which it appears that small-pox, diphtheria, measles, and dysentery prevailed during the year.

Dr. F. E. Beckwith has contributed remarks on the recent outbreak of typhoid or enteric fever at Southampton, L.I. Just why this report is printed in the 'Annual Report of the Connecticut State Board of Health,' does not appear, unless the explanation is to be found in the following paragraph: "The sanitary suggestions which close the paper apply not only to Southampton, but to every small seaside resort in a developing state, where there are similar conditions of soil, surface of country, and water-supply." The remarks are instructive and to the point, and are worthy a place in the report.

Eleventh Annual Report of the Board of Health of the State of New Jersey, and Report of the Bureau of Vital Statistics, 1887. Trenton, State.

In this report are the following papers: 'The Legal Aspect of the Pollution of Streams,' by E. S. Atwater; 'Air, Water, and Food,' by Ezra M. Hunt, M.D.; 'Outlines of Representative Sewer Systems,' by J. J. Croes, C.E., F. S. Odell, C.E., George P. Olcott, C.E., C. P. Bassett, C.E., and Charles McMillan, C.E.; 'Exposure and Diseases of Operatives,' by D. Warman, M.D.; 'Typhoid-Fever at Mount Holly,' by E. M. Hunt, M.D.; abstracts from papers and discussions of the New Jersey Sanitary Association; 'Report on the Water-Supply from the Passaic Watershed,' by Prof. A. R. Leeds, Ph.D.; and reports from the health-inspectors. The board's report also contains a list of persons practising medicine in the State.

In his paper on air, water, and food, Dr. Hunt discusses the influence of impure air on the death-rate, and refers to the investigations of this subject by Messrs. Carnelly and Haldane of University College, Dundee; and also those of Dr. Anderson, the health-officer of that city. Several experiments showed that the average of carbonic acid and organic matter was uniformly higher in town than in suburban or country air, and that in open places the carbonic acid during the night was less than during the day, as also the organic matter. Micro-organisms were less at night than in the day. In examining the air of the rooms of houses, it was found that carbonic acid, organic matter, and micro-organisms diminished in quantity as the cubic space per person increased from one hundred to one thousand cubic feet. The death-rate from phthisis was highest in three-roomed houses, which is accounted for by the fact that pulmonary consumption is seldom in the form of tubercular disease in young life; and in one and two roomed houses much fewer live to the consumption age, so as to diminish the material, and so make the actual death-rate lower. In reference to the purification of air independent of mechanical methods, the following recommendations are made: cleanliness of person and dwelling, and open-air spaces; frequent change of the air of the room; windows should be made to open above and below, and both sashes should be used as much as possible; the practice of having a lamp burning all night in bedrooms in small houses is greatly to be deprecated, as the heat, the organic matter, and the carbonic acid aid in the reduction and deterioration of the air. Dr. Hunt discusses schoolroom ventilation, and gives a large number of results of tests of the air in the schools of Hoboken. In speaking of water-analysis, he refers to the biological tests, and says that it would be premature as yet to claim any very determinate results, although much has been found that is valuable for comparison with chemical analyses. Dr. Hunt does not think it to be an important function of a health board to deal with the question of adulterated mustard or spices, nor with the sale of oleomargarine, inasmuch as it has never been shown that there is any serious risk to health in their use. He appreciates the desirability of preventing commercial frauds, but does not regard this as a function of health laws.

In the paper on sewèr systems, descriptions are given of the drainage and sewerage of the Lawrenceville School, Mercer County, N.J., and of the systems of Long Branch, East Orange, and Morris Plains.

The article on exposures and diseases of operatives is in the line of valuable work which the State board has been pursuing for some time; namely, an inquiry into the condition of workshops and factories, and as to the influence of the various trades and occupations upon the lives and health of operatives. The chief report this year is upon the pottery industry. Dr. Warman gives the results of his investigation of this industry in the following recapitulation: (1) that dust, and the liability to inhale it, is the principal cause of potters' asthma and potters' consumption; that the greatest number of sufferers from the above-named diseases occurs among 'china scourers;' (2) the greatest sufferers from lead-poisoning are dippers, and those assisting them, — glost-placers, mixers of colors, ground-layers, majolica and other painters, and those who 'fettle' ware after it is dipped; (3) that the pottery workmen most liable to rheumatic affections are ovenmen and kilnmen, who are greatly exposed to heat and strong draughts; they also suffer much from colds contracted from the sudden checking of the perspiration, which often terminates in acute inflammations of the chest; (4) that those engaged in sedentary occupations suffer most from disorders of the digestive organs, liver, and stomach, followed by general debility, defective blood-making, and hence bloodlessness, sensitiveness to cold, constipation, and a tendency to internal congestions; (5) the auxiliary causes are neglect of cleanliness, in work, in shops, in dress and in personal habits, inattention to ventilation and to the heat and moisture of the workshop, intemperance, and irregular living; that a large majority of workers do not remain continuously at the work for more than from fifteen to twenty years; finally, that the removal of the exciting cause or causes is the only rational means of preventing or interrupting the diseases of potters. Statistics show that pottery operatives in this country are in better health than those in the Old World.

Evolution and its Relation to Religious Thought. By JOSEPH LECONTE. New York, Appleton. 12°. $1.50.

IT is always with a deep sentiment of respect that we take up a book in which an earnest thinker expresses his views which embody a life's work, — the work of the author's mind in settling the puzzling questions that offer themselves at one time or another to every man; and the work of the subjects that have occupied him for years and years upon the evolution of his mind. For it cannot be but that the latter influence makes certain points of view more important to one man's mind than to that of another, and accordingly their final conclusions will differ either fundamentally, or at least to a certain extent. It is therefore not with the expectation that we will find *the* truth in a book setting forth the opinions of a man — for we doubt whether such truth exists — that we read a book of this kind, but it is the æsthetical and ethical pleasure we look for in listening to opinions that are true to one principle, and therefore consistent. It is with this feeling that we read Professor LeConte's book with the greatest interest and gratification.

His explanation of evolution in the introductory chapter opens a clear view to his thoughts: "Every system of correlated parts may be studied from two points of view, which give rise to two departments of science. The one concerns changes within the system by action and re-action between the parts, producing equilibrium and stability; the other concerns the progressive movement of the system, as a whole, to higher and higher conditions. . . . The one concerns things as they are, the other the process by which they become so." This idea has been expressed by other writers by the words, 'evolution is part of the science of history as opposed to the science of physics.' The author then proceeds to define evolution, which he calls "a progressive change according to certain laws by means of resident forces." It is not the object of this review to follow the author in his argument for proving the truth of evolution in the sense as here described. Neither is this argument the principal object of the book, which is an explanation of the relation of evolution to religious thought. The author emphasizes justly that by accepting the law of evolution we do not become materialists any more than by accepting the law of gravitation. In setting forth his views as to the relation of man to nature, he assumes physical and psychical phenomena as equally true, but their connection as only intelligible to an intelligence superior to that of man. He believes that in man physical changes may be produced by psychical changes, while in animals only the reverse is the case. His views on the relation of God to man are an attempt to reconcile the theological and positivistic views — as we should say, instead of LeConte's materialistic — from the standpoint that both contain some truth, and that God is immanent in nature. These conclusions are as much dictated by feeling as by reasoning, and therefore they will be convincing and satisfactory to some men, while they cannot claim to be as firmly founded as the results of scientific investigations.

Accidents and Emergencies. By CHARLES W. DULLES, M.D. 3d ed. Philadelphia, Blakiston. 16°. 75 cents.

IN the preface to this edition the author says that whoever has seen how invaluable, in the presence of accident, is the man or woman with a cool head, a steady hand, and some knowledge of what is best to be done, will not fail to appreciate the desirability of possessing these qualifications. To have them in an emergency, one must acquire them before it arises, and it is with the hope of aiding any who wish to prepare themselves for such demands upon their own resources that the suggestions contained in the book have been put together. They cannot take the place of calling a physician or surgeon, but may fill up with helpful action what might otherwise be a period of inaction and despair before skilled assistance arrives.

Among the many topics treated are drowning, suffocation, choking, foreign bodies in the eye, nose, and ear, fits, sunstroke, sprains, dislocations, fractures, wounds, hemorrhage, poisons, etc. The book also contains a list of the supplies which are necessary to meet such emergencies as are liable to arise in every family, and gives the doses and uses of the medicines commonly found in the family medicine-chest. The illustrations are good and sufficiently numerous. In order to make this little treatise available for sudden necessity, pains have been taken to make the index as complete as possible, and the typography has been so arranged that leading words may catch the eye on every page. The language is simple, being entirely devoid of technicalities, and the methods of treatment recommended are trustworthy and reliable. The manual is one of the best of this class of books, and should be in the library of every householder, ready for reference at a moment's notice.

Practical Education. By CHARLES G. LELAND. London, Whittaker. 12°.

THIS is an essentially vicious book. In these days, when all enlightened educators are calling for meat, it is an outrage to offer them such a stone as this. It is the more vicious because it is offered in the guise of a contribution to the literature of the new education. Some things in it are good, many are nonsensical, and all are superficial. There is no grasp of education shown in it, no psychological power, and no connected account of any successful practical experience. The number of times that the words 'I,' 'my,' 'mine,' 'me,' etc., occur is sufficiently numerous — or sufficiently innumerable — to characterize the work. It contains no reference, at least no intelligent reference, to the manual-training movement which is revolutionizing the American schools and the traditional course of study. It offers no suggestions as to the co-ordination in various grades of schools of 'industrial-art education' and the ordinary studies.

We fear that the title of this book may commend it to the attention of many who are conscientiously studying contemporary educational thought. We warn such readers that Mr. Leland's book is superficial, that it is crude, that it is representative of no important educational movement. Some of the points on which the author touches are in themselves commendable, and have been taken up by other writers. When this has happened, they have usually been based on some educational principle. With the author of this book they seem to be mere 'flashes in the pan.' He has not discovered that an 'art-writer' and an 'educator' are not necessarily convertible terms.

NOTES AND NEWS.

THE first number of the journal of the American Folk-Lore Society, which was recently organized, has just been issued under the title *The Journal of American Folk-Lore*. It shows how much work may be accomplished by a society of this character, and that the establishment of a centre for collecting the fast-vanishing remains of American lore was a necessity. The journal is devoted to the study of the relics of Old English lore, as well as to that of the Indians, negroes, and other immigrants, and the first number contains articles on each of these subjects. Prof. T. F. Crane contributes a paper on the theory of the diffusion of popular tales, while H. Carrington Bolton gives an interesting collection of the counting-out rhymes of children. The general editor, Mr. W. W. Newell, studies the alleged Vaudoux (Voodoo) worship and child-sacrifice in Hayti, and arrives at the conclusion that it is the old superstition regarding the Waldenses that has been transplanted to America. The Vaudoux of Hayti are the Waldenses of France, the word having been introduced in the seventeenth century; and the alleged practices of the latter are now ascribed to the Vaudoux. The second half of the volume is devoted to Indian lore. Dr. D. G. Brinton gives some remarks on the Lenâpé, Rev. W. M. Beauchamp relates tales of the Onondaga, while Rev. J. Owen Dorsey and Dr. F. Boas have articles on myths and customs of Dakota and British Columbian tribes. Much interesting and valuable information has been collected in the 'Folk-Lore Scrap-Book,' and students will find the bibliographical notes very useful. The first number of the journal augurs well for the development and usefulness of the society.

— Records of about 3,500 orders received by A. A. Marks, New York, for an artificial arm or leg are found sufficiently full to enable them to be tabulated for statistical purposes. Of all the artificial limbs made by the firm, 85 per cent are legs, and 15 per cent arms. This small percentage for arms may be explained by the fact that fewer persons who have lost their arms supply themselves with artificials than those who have lost their lower extremities, inasmuch as it is easier for a man to go through this world with one arm than with one leg; and, besides, an artificial arm for amputation above the elbow is of so little service, aside from appearance, that few persons with amputations above the elbow ever use them. Taking these facts into consideration, the percentages referring to arms cannot be regarded of very much value in estimating the comparative restorations of the upper and lower extremities. Of all the legs taken into consideration, 49 per cent are right, 46 per cent are left, and 5 per cent both. The above figures show that the proportion of right legs amputated to left is nearly even, with the small difference of three per cent in favor of the right. Seventy-eight per cent of legs amputated are of males, and twenty-two per cent of females. The proportion for double amputations of males is nearly double that of females. This may be explained by the fact that males are more frequently placed in jeopardy than females. Over one-half of all the amputations are between the knee and ankle, with a larger percentage for males. Of all the arms manufactured by the firm, ninety-two per cent are for males, and eight per cent for females.

— A. H. Worthen, State geologist of Illinois, is dead.

— Mrs. Emma W. Hayden has given to the Academy of Natural Sciences of Philadelphia, in trust, the sum of twenty-five hundred dollars, to be known as the Hayden Memorial Geological Fund, in commemoration of her husband, the late Prof. Ferdinand V. Hayden, LL.D. According to the terms of the trust, a bronze medal, and the balance of the interest arising from the fund, are to be awarded annually for the best publication, exploration, discovery, or research in the sciences of geology and paleontology, or in such particular branches thereof as may be designated. The award, and all matters connected therewith, are to be determined by a committee to be selected in an appropriate manner by the academy. The recognition is not to be confined to American naturalists.

— Two living buffaloes, the gift of Fish Commissioner Blackford of this city have been added to the small collection of animals gathered in the Smithsonian grounds in Washington during the past few months. A bill has already been introduced into Congress for the purchase of a large tract of the beautiful suburban lands lying along Rock Creek, just outside of the city limits of Washington, and the establishment upon it of a government zoölogical garden. The bill may not be passed this year, but the few living animals now in possession of the National Museum are no doubt the nucleus of what will in a few years be a very important national zoölogical collection. Professor Hornaday has been made curator of living animals.

— An exhibition of the first year's industrial work in the Washington public schools will be given at the close of the present month. Professor Powell, the superintendent, does not expect to make as brilliant a display as that recently made in Philadelphia, and in other cities where manual training was introduced earlier; but he will show astonishing results, when it is considered that only five thousand dollars has been spent in fitting up shops and cooking-schools, and a year's expenses, including materials used, and that the pupils whose work will be exhibited have had instruction only one hour a week for a year.

— A geographical society has been formed in Peru for the purpose of collecting and publishing information regarding Peru. The society, which will be known by the name 'Geographical Society of Lima,' counts a number of eminent explorers and scientists of South America among its founding members.

— The Government of Ontario is about to take more energetic measures for the development of its mines, and as a preliminary step has appointed a royal commission to inquire into and report upon the subject. Members of the commission are Dr. R. Bell of the Canadian Geological Survey; W. H. Merritt, mining engineer; W. Coe, proprietor of the Madoc iron-mines; and A. Blue, deputy minister of agriculture; while John Charlton is chairman.

LETTERS TO THE EDITOR.

**** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

Twenty copies of the number containing his communication will be furnished free to any correspondent on request.

The editor will be glad to publish any queries consonant with the character of the journal.

Is the Rainfall increasing on the Plains?

MR. CURTIS does a service in calling attention to the serious error in the rainfall record of Fort Leavenworth for January, 1871 and 1872. It is to be hoped that any errors of this kind will be similarly pointed out.

The data on secular variation in rainfall, p. 19, *Monthly Weather Review* for April, 1887, show, however, that, even with these errors corrected, the rainfall at Leavenworth for the past twenty-five years has been considerably greater than for the previous twenty-five years. There is no doubt that material errors existed in the old records, some of which are due to neglect or falsification of records, while others, as in this case, are due to gross carelessness.

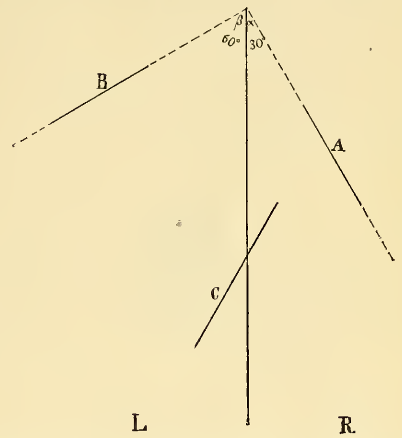
Rainfall data are now being collated by the Signal Office with a view to their examination and discussion; but the more the records are examined, the more possible it seems that observations prior to 1870 should be neglected, except in cases of well-known and reliable observers. A. W. GREELY.

Washington, D.C., May 12.

Disparate Vision.

MR. HYSLOP'S experiments in physiological optics as detailed in *Science*, Nos. 261, 262, and 274, are interesting in that they show the importance of monocular perceptions in attaining what we may think to be binocular effects, even though they may not fully disprove the generally accepted theory of corresponding retinal points. Having devoted much time to this subject (see *American Journal of Science* for November and December, 1881, March, April, May, October, and November, 1882), I may perhaps claim some practice in experiments of this kind. The result of former investigations was my total abandonment of the geometric considerations which formed an integral part of Brewster's theory of binocular vision, and which have been repeated time and again since his day. The empiristic theory, as developed by Helmholtz, seems more consistent with the more general theory of evolution now universally accepted as fundamental in biology. According to this, we rapidly learn in infancy to interpret our binocular perceptions by experience that is too complex for analysis. Assuming a certain inherited structure for the retina, which is alike for the majority of individuals of the race, it remains possible to modify our perceptions slightly by training; and it would not be safe to deny that in exceptional cases binocular perceptions may result from simultaneous impressions on retinal points that are decidedly disparate. I have elsewhere adduced arguments to show that no strictly mathematical interpretation can be put upon the theory of corresponding points (*American Journal of Science*, May, 1882, p. 355 *et seq.*). The perception of the third dimension in space without any of the aids resulting from shading, comparison, or motion, has lately been shown to be quite possible with monocular vision alone (*American Journal of Psychology*, November, 1887, p. 99, article on the Horopter, by Mrs. Franklin). I had no difficulty in attaining this monocular perception in repeating Mrs. Franklin's experiments.

But although constrained to assign much greater potency to monocular vision than was customary after the stereoscope became generally known and used, and although our interpretation of binocular perception has to be much more elastic than it formerly was, there seems to be not yet sufficient ground for the belief that any large part of our binocular perceptions are the result of impression on pairs of retinal points that are widely disparate. The same perception may be changed by force of will or of imagination, and with various degrees of success by the same person at different times. Without denying the validity of Mr. Hyslop's perceptions, I do not succeed in getting exactly his results. Combining the two circles by either convergent or divergent vision, the binocular effect is an ellipse whose plane is perpendicular to the meridian plane only when their inclinations to this plane are equal. This perception is rigidly binocular. Let, now, their inclinations be different. For example: let the plane of the circle A make an angle of 30° with the meridian plane, and B an angle of 60°, the two being seen by cross-vision. In the accompanying diagram the cards are supposed to be seen edgewise, the two eyes being at R and L. The plane of the resultant ellipse changes about to the position C; the horizontal axis, which was previously the shorter one, becoming now much longer than the vertical axis, which has remained unchanged. The projection of the circle A on the retina L is quite a narrow ellipse, while that of B on the retina R is almost if not quite circular, the vertical diameters of these ellipses being nearly equal. At the top and bottom of the resultant ellipse the perception may be due to impression on corresponding retinal points, while for other parts the impression is on disparate points. Very little attention is required to perceive the separate monocular images. By still further diminishing the angle α and increasing β, a limit is reached at which binocular fusion ceases to be possible. Two ellipses are seen, apparently crossing each other in space about where C was; the plane of one being nearly parallel to A, and that of the other nearly parallel to B. By indirect monocular vision, A is still seen by the right eye, and B by the left. The locality of the crossed ellipses is not so definite as was that of the binocular ellipse; but the illusion of suspension in space still remains, and with it is the monocular perception of the third dimension in space. Even when α is very nearly equal to β, it is possible by rivalry of retinal impressions to gain or lose monocular perceptions alternately with binocular resultants. But the clearness of the binocular illusions is more pronounced than that of the monocular in proportion as the separation of the disparate points impressed becomes less. It is fair to conclude that binocular vision is at its best when there is perfect correspondence of at least a goodly proportion of the retinal points impressed, and but slight separation of disparate points. But it is quite necessary, in the majority of cases, that there shall be some such disparateness. The mental effect produced is instantaneous. Since double images, whether homonymous or heteronymous, are rarely ever perceived except as



the result of special ocular training, and since the binocular perception of depth in space may result where one element may, on geometric grounds, be considered to be combined with other elements so as to produce at the same instant both homonymous and heteronymous double images (*American Journal of Science*, October, 1882, p. 5), binocular vision is far from being so simple and easy of explanation as it seemed to the students of forty years ago.

W. LECONTE STEVENS.

Brooklyn, N.Y., May 5.

Agriculture and Late Quaternary Geology.

IN view of the effort now being made to endow the United States Geological Survey with the means of carrying into effect the "classification of lands" called for in the act creating it, it may be of interest to record one out of many instances where this classification, in connection with agricultural phenomena, affords information equally interesting to the geologist and the farmer.

At a late visit to the upper San Joaquin valley for the purpose of locating on a representative soil a culture experiment station under the Hatch Act, the writer was under the necessity of obtaining a cross-section of the great valley in the latitude of Tulare City, from Lake Tulare on the west, to the foot-hills of the Sierra Nevada on the east.

The dark-tinted loam-deposits at present forming on the edge of that lake being already familiar, it was easy to recognize in the 'black-lands' belt, that begins about two miles westward of the

Southern Pacific Railroad (here running midway between the Sierra and the lake), the earliest border of that basin, distant quite fourteen miles from the lake-shore as recorded on the maps, but which itself is now several miles inland from the water's edge. The railroad and Tulare City lie on a belt of sandy land, obviously somewhat higher in level than the 'black lands,' and here about eight miles wide. In crossing this belt to the eastward we traverse several bands of 'alkali land,' characterized by the dense growth of *Brizopyrum*, or 'alkali-grass,' and evidently forming a summit plateau on the divide between the Tulare basin proper and the extreme southern branch of the delta bayous[1] of the Kaweah River, called 'Outside Creek,' or Elk Bayou. Approaching this water-course, we again come to a 'black-lands' belt, about three miles wide, which borders the bayou on both sides, and evidently represents an estuary of the time when Tulare Lake was much higher than now, and the Kaweah delta bayous were mere swamps. Another 'alkali-land' belt is crossed after traversing the 'black-lands' of Outside Creek, towards the foot-hills: beyond these, lies a narrow sandy belt corresponding to that along the railroad, as above described. Then, at a distance of some eight miles from the foot-hills, the color of the soil begins to change toward the well-known red tint of the soils resulting from the decomposition of the 'bedrock' slates of the foot-hills; but the ascent is so gradual that to the eye the plain appears as level as ever, although the presence of the ferric hydrate in the soil proves that these 'red lands' were never submerged for any great length of time, since otherwise their iron would have been reduced and leached out, or gathered into 'black gravel' (bog-ore), as is the case in the 'black lands' of the lake and bayou borders. On inquiry, it was learned that all the larger streams of the region (including Tule River and Deer Creek, outside of the Kaweah delta) are accompanied by belts of such 'black land.'

Besides these main bayous, there appear in the sandy lands a few obvious sandy channels, usually dry, but carrying water in time of flood.

But a curious and at present very striking demonstration of the ancient drainage system of the region may be seen in the grain-fields. In consequence of the failure of the usual April rains, most of the wheat-fields of the region are now in a very precarious condition where not irrigated, and much of the wheat sown will not even make hay. Its condition is best on the 'black lands,' and in certain portions of the sandy belt that do not show any obvious difference in soil from adjoining tracts in which the crop is already dried up without having been able to form grain in the ears. The eye quickly recognizes the extraordinary resemblance of the outlines of the dead portions to meandering water-channels, but no difference of surface-level remains to indicate the fact. But, by digging in any part of these meandering belts of desolation, we find the sandy soil becoming sandier as we descend, until finally, at about three feet depth, an almost pure, coarse sand underlies, which obviously cannot raise moisture within reach of the root system. On the adjacent land, where the wheat is still green and growing, we find at the same depth a subsoil of increased closeness and capillary power, which keeps the moisture below within reach of the roots.

Thus a bird's-eye-view photograph taken of this region now, would show, traced out in minute detail by the color-contrast between the living and the dead grain, the ancient drainage of the country, of which its surface at present shows no indication, together with the broad bands of the ancient estuaries that have formed the 'black lands,' characterized by green, growing grain or an extraordinarily luxuriant growth of oaks, that likewise outlines the ancient margin of Lake Tulare.

We thus obtain a chapter of the geological history of the valley from a mere reconnaissance such as any one desiring to invest in its lands would need to make. The significance of the 'alkali lands' in both points of view remains for a future discussion.

It is hardly necessary to dwell upon the interest attaching to the study of these features, whether from a practical or a purely scientific standpoint. One point, however, should be specially noted: namely, that a great many of the characteristic marks of these late quaternary events are rapidly disappearing before the advance of cultivation, and the replacement of the native plant-growth (the result of secular co-adaptation of soils and plants) and of the natural surface by the well-known results of agricultural operations. The latter are already obliterating, on large tracts, the singular 'hog-wallow' mounds that form so striking a feature and so difficult a problem, the solution of which must largely depend upon the geographical distribution of these swarms of mammillary elevations.

It is hard to see on what ground the study of these latest phenomena, connecting the present with the immediate geological past, should be deferred until it is too late to complete the record, by giving precedence altogether to the ancient formations. The rocks and fossils of the older formations will remain undisturbed for ages, as in the past, awaiting the leisure of the student of geology; while the delicate tracings of the latest pre-modern epochs are liable to fade away rapidly before the advancing settlement of the country. Nor can it be maintained that the processes that gave them birth, and which are still active in the formation of soils, are not scientifically, as well as practically, at least of equal interest with those that formed the older rocks. It is true that their study does not offer the easy rewards of the naming of new fossils, minerals, and rocks, which in times not yet belonging to the far past seemed to be the chief aim of students of geology; but they are none the less worthy of the highest scientific effort, and their practical results bear on products of an importance at least as great as those of the richest mines.

E. W. HILGARD.

Berkeley, Cal., May 1.

[1] It should be understood that the Kaweah River, emerging from a cañon of the Sierra next to southward of King's River, divides into a number of forks or bayous immediately upon entering the valley plain. The extensive delta region thus formed is one of the richest, as well as the only forest-grown area of the great valley of California.

Queries.

32. HUMAN BEINGS AS PACK-ANIMALS. — In studying the history of transportation, I have ascertained that the first pack-animals were human beings, — men and women. Long before any of the animals were domesticated as beasts of burden, there were common carriers moving vast quantities of merchandise about the world. They toted (carried on the head); they hung great loads to their foreheads by means of a strap connected with a pack, wallet, basket, or frame on the back; they 'shouldered' their burdens, with or without yokes, front and rear, on one shoulder (like the Chinese) or on both shoulders (like the Dutch); they strapped their primitive knapsacks to their shoulders; they harnessed themselves to a load, as they did afterwards dogs, reindeer, horses, etc. Now, I should also like to know how much a man can tote, how much a woman can tote, and how long a time, without resting, the toting may go on. I should also like to know how much a man or a woman can carry in any particular manner, and how long a time the operation can be kept up without resting. The weight multiplied by the time will give a rough unit of human endurance. I shall be extremely obliged to any one who will give me valuable information on this subject. O. T. MASON.

Washington, D.C., May 10.

Answers.

22. WASP-STINGS. — It is a fact not generally known, that, if one holds his breath, wasps, bees, and hornets can be handled with impunity. The skin becomes sting-proof, and holding the insect by the feet, and giving her full liberty of action, you can see her drive her weapon against the impenetrable surface with a force that lifts her body with every stroke; but, let the smallest quantity of air escape from the lungs, and the sting will penetrate at once. I have never seen an exception to this in twenty-five years' observation. I have taught young ladies with very delicate hands to astonish their friends by the performance of this feat; and I saw one so severely stung as to require the services of a physician, through laughing at a witty remark of her sister, forgetting that laughing required breath. For a theory in explanation, I am led to believe that holding the breath partially closes the pores of the skin. My experiments in that direction have not been exact enough to be of any scientific value, but I am satisfied that it very sensibly affects the amount of insensible perspiration. W. L. WILDER.

Somerville, Mass., May 7.

BOOK-NOTES.

— D. C. Heath & Co. will publish, May 5. 'Exercises in English, a Drill-Book on Accidence, Syntax, and Style,' by H. I. Strang.

— 'Noble Deeds of our Fathers as told by Soldiers of the Revolution, gathered around the Old Bell of Independence,' is the name of an interesting book, revised and adapted for supplementary reading in schools, and for school libraries everywhere, soon to be published by Lee & Shepard, Boston.

— *The Novelist* (published weekly, at one dollar a year, by J. B. Alden, New York) undertakes to give the worthiest fiction that American authors can be tempted to produce. The stories will follow successively, one at a time, a novel of ordinary length thus being completed in from four to eight weeks.

— John Wiley & Sons, New York, announce as in preparation 'Rocks and Soils,' a treatise on the chemistry of geologic transformations and soil composition, by H. E. Stockbridge; 'An Elementary Course of Descriptive Geometry,' by Solomon Woolf; 'Microscopical Physiography of Minerals and Rocks,' Vol. I., by H. Rosenbusch, translated by Joseph P. Iddings; 'Differential Equations,' by Prof. W. W. Johnson; 'A Grammar of the Hebrew Language,' by W. H. Green; and 'A Treatise on Hydraulics,' by Prof. Mansfield Merriman.

Calendar of Societies.

Philosophical Society, Washington.

May 12. — W. A. Croffut, Experiments in Hypnotism.

Biological Society, Washington.

May 5. — R. E. C. Stearns, Instances of Mutations in Specific Distribution among Shells; C. L. Hopkins, Notes upon Pollenation of the 'Nave' Oranges; C. Hart Merriam, Description of a New Meadow Mouse, with Remarks on the Subgenus *Pedomys*; Lester F. Ward, On Some Characteristics of the Flora of the Potomac Formation.

Torrey Botanical Club, New York.

May 8. — H. H. Rusby, Andean Fern Habitats; R. G. Eccles, Preservation of the Color of Flowers by Chemical Preparations; N. L. Britton, Notes on Nelumbium.

American Institute of Electrical Engineers, New York.

May 15. — Nikola Tesla, On a New System of Alternate Current Motors and Transformers; Francis B. Crocker, The Possibilities and Limitations of Chemical Generators of Electricity; G. W. Plympton, Underground Electrical Systems in Europe and America; Edward L. Nichols, On Compensated Resistance Standards, and On Professor Moler's 'Swinging Arm' Galvanometer; George H. Stockbridge, The Patent Court and Uniformity in Patent Practice; P. B. Delany, Protection of the Human Body from Dangerous Currents.

Connecticut Academy of Arts and Sciences, New Haven.

May 16. — H. A. Newton, Orbits of Aerolites.

Boston Society of Natural History.

May 16. — Alpheus Hyatt, The Evolution of Faunas in the Lower Lias; W. O. Crosby, The Geology of Nantasket.

Publications received at Editor's Office, April 23–May 12.

AGASSIZ, A. Three Cruises of the United States Coast and Geodetic Survey Steamer "Blake." Vols. I. and II. Boston and New York, Houghton, Mifflin, & Co. 314+220 p. 8°. $8.

EGLESTON, T. Some Thoughts and Suggestions on Technical Education. New York, The Author. 39 p. 8°.

FOLK-LORE, Journal of American. Vol. I. No. 1. April–June. Boston and New York, Houghton, Mifflin, & Co. 96 p. 8°. $3 per year; single numbers, $1.

FRITSCH, K. v. Allgemeine Geologie. Stuttgart, Engelhorn. 500 p. 12°. $3.50.

GRAY, A. Synoptical Flora of North America. The Gamopetalæ. (Smithsonian Miscellaneous Collections, No. 591.) Washington, Smithson. Inst. 973 p. 8°.

GREELEY Exponent, The. Vol. I. No. 1. April, 1888. *m*. Greeley, Col., D. W. Elliott. 8 p. f°. 50 cents.

HALLER, L. Alles in Allen. Metalogik, Metaphysik, Metapsychik. Berlin, Duncker. 480 p. 8°.

HEPITES, S. C. Analele Institutului Meteorologic al Romaniei pe anul 1886. Bucuresci, F. Göbl Fii. 322 p. f°.

HILL, G. A. Lessons in Geometry. Boston, Ginn & Co. 182 p. 12°.

MARGERIE, E. de, and HEIM. A Les Dislocations de l'écorce Terrestre. Zürich, J. Wurster & Co. 154 p. 8°.

PENNSYLVANIA Geological Survey, Annual Report of the, for 1886. In four parts. With atlas. Harrisburg, Geol. Surv. 1329 p. 12°.

TIMSOL, R. A Pessimist; in Theory and Practice. New York, J. B. Alden. 204 p. 12°. 30 cents.

UNDERWOOD, L. M. Our Native Ferns and their Allies. 3d ed. New York, Holt. 156 p. 12°.

SCIENCE

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SCIENCE

FRIDAY, MAY 25, 1888.

THE DISCUSSION in the New York City Board of Education concerning the succession to Superintendent John Jasper is attracting very general attention. This is necessarily so, because the position of superintendent of schools in New York City is one of great influence and power, and its incumbent ought to be one of the foremost educators of the country. He can mould or make more characters and more intelligences a hundred times over than the most powerful college president. His voice should be heard in educational gatherings, and his counsel should be sought all over the country. He should inspire and lead on his great army of teachers to greater efforts for success in their work. He should be a wise, careful, and unprejudiced administrator. The present incumbent of this great post has held his position for nine years, and during the whole of that time the schools of New York City have been looked upon with contempt by all qualified students of public education. From the standpoint of organization and system, they are magnificent, but they are not educational. Rigid technical requirements and an awful dread of a preposterous marking system rule teachers and pupils alike. Every natural instinct, every activity of the pupil, is recognized only to be crushed and held in check. Superficial results such that they may be estimated in fractions of a per cent are the end and aim of the scholastic exercises. Examinations, inspections, and marks recur with fearful tirelessness; and above and behind them all sits the city superintendent, — a mere calculator of results and percentages. He is unknown to the educators of the country; his face and voice are unfamiliar to every educational gathering. His teachers have no meetings or institutes worthy the name. At least two-thirds of his assistants are disqualified for their positions by age or incapacity. It is freely charged that base and unworthy motives find play in many official actions. More definite charges of other kinds, all turning upon the inefficiency and delinquency of the present administration, have been made in the Board of Education and elsewhere. For these reasons, vigorous and effective opposition is being made to the proposition to continue indefinitely this state of affairs. All fair-minded men, and especially all educators who realize the importance of the New York city schools, should support in this crisis those members of the Board of Education who are making this fight for a principle. This is no time for personal considerations nor for petty jealousies. Argument should turn on the highest good of the schools alone. That that can be best served by a radical reform in present methods of administration and discipline, is obvious.

AFTER AN INTERVAL of about eight months, news has been received from Major Barttelot, commander of the camp at Yambuga Rapids, which confirms the favorable view regarding the state of affairs in Central Africa, taken by all who have watched the events closely. The cable reports the following message: "No news from Stanley since I wrote, toward the end of October. Tippo-Tip went to Kasongo on Nov. 16, but in March he had procured only two hundred and fifty carriers. Jameson has gone to Kasongo in order to hasten the despatch of three hundred and fifty carriers more, which Tippo-Tip promised to furnish. Jameson will be back here on May 14. I cannot leave until June 1. I shall pass Stanley Falls Station, where I shall leave an officer with all that is not absolutely necessary. All are well. — Barttelot." This news was brought by Mr. Ward from Barttelot's camp to Stanley Pool, but we fail to learn how he descended the river. The important facts we learn from this despatch are these: that the fear that Tippo-Tip might have betrayed Stanley, which was entertained by many people, was groundless; that Barttelot has had no difficulty in obtaining provisions for his men; and that the Arabs of Stanley Falls are again friendly towards the whites. All these are reassuring facts, and we may assume that ere long we shall hear of Stanley's safe arrival at Lake Mvutan. It is useless to speculate what he is going to do next.

COMMANDER JOHN R. BARTLETT, who for the past six years has been chief of the Hydrographic Office of the Navy Department, has been relieved from duty, and granted leave of absence for a year. He will accept the superintendency of the Union Street Railroad of Providence, R.I., a position which was offered him several months ago, and which has been held for his decision. A proposition was made not long ago to make the Hydrographic Office one of the regular bureaus of the Navy Department, with an officer at its head nominated by the President and confirmed by the Senate. This has been defeated by the opposition of naval officers, which has been provoked to some extent, it is believed, by jealousy. The defeat of this movement undoubtedly caused Commander Bartlett to ask to be retired. Before Commander Bartlett took charge of the Hydrographic Office, it was scarcely more than a depository for the charts of vessels. He has made it, under Commodore Walker, one of the most useful and important branches of the government. Its sailing-charts are most highly prized by mariners of all nations, and its Pilot Chart is the best published anywhere in the world. It has received frequent recognition by learned societies of Europe, and from the leading naval officers of foreign countries. By the establishment of branch offices at several of the most important ports on the Atlantic coast, it has succeeded in getting into very close relations with the merchant marine of the country, and in securing from it a great fund of the data of which it has made valuable use. The Hydrographic Office, under Commander Bartlett, was the first to direct attention to, and press upon, mariners the use of oil to smooth the waves of the sea during or after storms. By persistently calling attention to it, and publishing upon the Pilot Chart the reports of masters of ships who had successfully used it, the subject was forced upon the attention of navigators, until no properly equipped captain will now go to sea without his supply of oil and the means of using it. The logs of all incoming vessels are carefully examined, and all unusual phenomena are noted. In this way the history and movements of storms have been traced, plotted upon charts, and published, thus adding very greatly to the scope of meteorological science. Water-spouts have been described, and the accounts of them given by the officers of different vessels collected and compared; so that much has been added to what was previously known about them. Hurricanes have been traced, and the accounts of the officers of different vessels which encountered them have been collated and compared; so that the laws that govern them are now better understood than they were before. In this way the Hydrographic Office has become one of the most important of the government scientific bureaus. Lieut. George L. Dyer, assistant hydrographer, who has been associated with Commander Bartlett from the beginning, and has been a most efficient assistant, has assumed charge of the office, and will continue in the place until an appointment is made.

MYTHOLOGY AND AMERICAN MYTHS.

MR. JEREMIAH CURTIN, of the Bureau of Ethnology, read a paper on this subject before the Anthropological Society of Washington recently. "Mythology," he said, "is sometimes called the science of myths; but no man, I think, who knows the present condition of mythology would venture to call it a science. To begin with, there is no agreement as to the origin or meaning of a myth among any considerable number of men occupied either in explaining or studying mythology. The masters disagree, and the disciples are at swords' points. How can you have a science when you are not agreed as to the nature of its subject-matter? The question, 'What is the origin and nature of the story to which the name "myth" is given?' is answered in a variety of ways, — proof positive either that the true answer has not been given, or, if given, students of mythology are unable to perceive it. To go no farther than England, we find two different answers given to the question, in the form of two different theories.

"The first of these theories may be called the 'theory of oblivion;' the second, the 'theory of confusion.' Max Müller's theory of oblivion is founded on the hypothesis that men did not and could not make myths till they had forgotten who the chief actors in these myths were; that myth-makers only began to work when they had no means of knowing what they were working with, or with whom they had to deal in making up their stories; Müller's dictum being, 'It is the essential character of a true myth that it should no longer be intelligible by reference to a spoken language.'

"Herbert Spencer's theory of confusion is founded on the supposition that myths owe their origin to a confusion in the minds of primitive people, who worship their own earthly and natural ancestors under the guise of beasts, birds, reptiles, and plants, because these ancestors, when alive, received the names of beasts, birds, reptiles, and plants, and, after being dead two or three generations, were confounded with those creatures or plants. So the people who began by worshipping the ghosts of ordinary human beings, their own fathers, fell to worshipping wild beasts, snakes, birds, and insects, from whom they thought themselves descended by the ordinary process of fleshly generation. To fill out the whole list, men, if their ancestors came from the east, were descended from the sun; if from beyond the sea, they were descended from the sea; if from a mountain, the mountain was their ancestor. This theory is discussed with as much seriousness as if it had foundation or proof in the world, as if it had ascertained facts to support it.

"Besides these two theories, we have a method of studying mythology which is ably explained by Andrew Lang, author of the article 'Mythology' in the 'Encyclopædia Britannica.' According to this method, Aryan mythology had its beginnings when the ancestors of our race were in the same condition as the ancestors of the American Indians and other contemporary uncivilized races of the earth, when they began to make their myths; and therefore all that seems anomalous to us, all that Müller calls silly, senseless, and savage in Aryan mythology, is a survival from times when the Aryans were in the same stage of thought and development as the men who made the savage myths: consequently Aryan myths are to be explained by comparison with myths of savage races, and by a study of man in the sum of his manners, ideas, and institutions.

"England cannot tell us at present what a myth is. Though England has one of the finest myth-fields in the world to work in, Englishmen have done little in collecting myths, except in a desultory fashion — nothing toward collecting them in their integrity, with all their details, and in such groups that they would throw light on each other. Now, can we in this country describe the nature and origin of a myth? The Bureau of Ethnology has a collection of at least fifteen hundred stories obtained directly from the Indians of North America. Many of these stories are true myths from the earliest period. The collection is an important one, the largest yet made in any country, so far as known, and I believe also the most valuable. Now, if we were asked to tell what myths are, we should be safe in answering, 'We can tell what the oldest and simplest myths in the Bureau of Ethnology are.' My answer, based on the myths I have collected and on those I have examined, would be, myths are stories in which the characters are represented as persons who brought about by their activity every thing that took place in the world of the senses and imagination of the men who framed the stories.

"The myth-persons are always and without exception nonhuman. They appear as animals, including birds, fishes, reptiles, insects, and sometimes shells, stones, plants, and fruits, all of which are persons; for in myths there are as many persons as there are individual entities. There is another very important category of persons, — the seasons; certain processes in nature; certain objects in nature, as the sun, moon, and stars; the four cardinal points; the highest point in heaven, and the lowest point under the earth. Many of these, on account of not belonging to the animal personages, became assimilated and confounded with men sooner than the others. These animals of mythology are the reputed ancestors of the Indians who have totems, and, I believe, of all the primitive people of the earth who have totems. The spirits of these animals are the familiars or attendant spirits of the medicine-men among all Indians, whether they have totems or not. The Indians of California have no totems, but their medicine-men are aided by animal or elemental spirits. The myth characters, though appearing as persons having volition and desires, eating, drinking, and living the ordinary lives of men, have wonderful powers and peculiarities. In certain directions they are unconquerable, and bring about all the things in nature observed by the myth-makers. This is the true source of the grotesque and strange things in mythology. Thus we find a person performing all the acts of a nature power, and at the same time entering into such relations of love, hatred, enmity, and friendship as exist among men; becoming the husband or wife of another nature power or process, or being the offspring of two nature powers. These myth characters are armed only with weapons and appliances of men in an early stage of development. There is no correspondence between the alleged cause and the visible effect; but, to compensate for their outward and evident insufficiency, these weapons have a magic virtue; and the persons using them, powers beyond comprehension, and peculiar to themselves. These persons are represented as doing things which no living agent could ever do, which only the forces of nature do. On the other hand, the forces of nature are in myths represented as doing the things that only men do. When to these two features are added the customs, ways of thinking, and social habits of the early myth-makers, there is plenty of room for the most ludicrous and unheard-of adventures, as well as cruel and revolting deeds.

"The earliest myths are the simplest in structure, and the persons in them are those that come under the observation of primitive man soonest: animals, objects, and processes in nature belong to this category. Later, because more complicated, and involving the participation of these forces, are the creation myths, with which are intimately connected myths concerning the origin of the arts necessary for the maintenance of life; games; forms of dress and ornament; the observances necessary to obtain the favor and assistance of the elemental powers or spirits, who, in nearly all cases, are represented as animals, birds, reptiles, etc., of pre-human time, or, as the Indians phrase it, 'of a world before this.' But, no matter in what forms they are presented, they are always called people. The same term is applied to them as to the Indians of to-day, — among the Iroquois Senecas, *ongwe;* among the Modocs, *maklaks;* among the Yana, *yana;* and so on, through every stock in America.

"But before proceeding further, it is best, perhaps, to give in condensed form the myth of the birth of thunder and lightning. The characters in this story are, Wimaloimis (grisly-bear maiden); Sula pokaila (mountain-trout old woman); the thigh-bone of the western red-tailed hawk; and Walokit and Tumukit (lightning and thunder), born of the grisly bear.

"The Grisly Bear comes to the house of the Trout, and asks for a night's lodging. Next morning she tries to eat up the Trout; but the latter turns into water, and escapes. Now, the Grisly Bear sets up her home at that place, and, finding a thigh-bone of the red-tailed hawk, hangs it up in the centre of her house, looks at it continually, and from looking becomes pregnant. She brings forth twins. Walokit (lightning) is born first. The moment he is born, she turns to eat him up; but he, prophetic in mind, knows her thoughts, and flashes up so brightly that she is frightened, and drops him. Next, Tumukit (thunder) is born. She tries to swallow him; but the infant roars so loudly, that she, terrified almost to death, rushes out of the house, and away on to a mountain, which is called Grisly Mountain to this day. At the birth of the twins the thigh-bone became a hawk, and flew away to the sky. The Trout comes to the deserted twins, and rears them. The boys call her grandmother. When grown up, they are anxious to know who their mother and father are. The old Trout said, 'Your mother is Grisly Bear, a bad woman. She tried to eat me up, tried to eat you up as soon as you were born. She is living on that mountain over there now. She is a bad woman. But your father is a good man: he is Lade herrit' (the red-tailed hawk).

"The brothers go in search of their mother, find her. She pretends to be fond of them, tries a second time to eat them, again is frightened and runs away. Later the brothers find her, and this time they kill her. Then they go home, purify themselves after the matricide, and set out to look for their father. 'He is up in the sky,' said Sula pokaila (the old trout), 'but before you go, here is a cup of trout's blood. The cup will always be full, no matter how much you take out. This will always give you strength.' They went up to Nomhlestawa, who lives in Olelpanti (above in the high), who said, 'Stay with me. I will employ you when I need you.' He gave Thunder large balls, which he tied to his ankles; and they make a great noise now, as he runs through the sky. In the tones of Thunder is heard the voice of a Grisly; for he resembles his mother, and inherited her voice. But Lightning is like his father: he flashes with brightness as he goes.

"This is the account of how lightning and thunder were born into the world, — a beautiful myth, true and easily understood, — a myth of great value, for it reveals with the utmost clearness the process of genuine myth-making.

"Compare this with the Sanscrit myth of the creation of Indra's thunderbolt (I quote from memory): Vritra, at the head of his immense host, pursued Indra and the Celestials in every direction. Then Indra and the gods went to Brahma, and stood before him with joined hands. Brahma said, 'Every thing that ye seek is known to me. I know your desire: you want to kill Vritra. Now, I will tell you how to do it. There is a high-souled and great Rishi named Dadhichi. Go all of you to him and ask a boon. Say ye to him, "For the good of the three worlds give us thy bones." Renouncing his body, he will give you his bones. With these bones of his, make a weapon, which you will call *vajra*, capable of destroying every enemy. With this weapon will Vritra be slain.' They went to the holy hermit, who lived in a jungle on the bank of the Saraswati, and begged the boon, which was granted. The Rishi gave them his body, and left it of his own volition. They took the bones and carried them to Twashtri (the celestial artificer), who was filled with joy when he knew what they wanted, and, going to work, made of the bones the thunderbolt, *vajra*, which he gave to Indra, who, armed with it, went at the head of the Celestials to attack Vritra, at that moment occupying all the earth and the heavens. After a terrific encounter, and after he had borrowed strength from all the Celestials, Indra hurled the *vajra*, and Vritra, great as a mountain, fell headlong. His host fled, and took refuge in the sea.

"In the American myth there are few, if any, doubtful elements. The characters tell their own story. The Sanscrit myth is an interesting example of how similar results may be worked out in different ways in two mythologies.

"If American myths are used to test the value of the two theories in England to which I have just referred, it will appear with reference to the first, — Max Müller's theory, — that mythology does not owe its origin to any action of language whatever; neither to a disease of language, nor to the influence of language on thought. The framers of the earliest myths — the myths on which succeeding ones were fashioned, and from which characters and materials were borrowed in after times; the myths which were preserved with the greatest care, and are most sacred in the minds of the people to whom they belong — were men who described what they saw in the most direct manner. The earliest myth is a simple narrative in which the names of the actors were understood in all cases: in most cases they are understood down to the present day. Whatever difficulty there may be in interpreting such myths was not caused by linguistic influence.

"In a later period of myth-history, linguistic influence is apparent; in particular cases it may be great, in some mythologies more prominent than in others; but it is never a main factor, never a predominant element, never the parent of mythology.

"If American myths are to be used to test the second theory, — that of Herbert Spencer, — which affirms that mythology, no matter what forms it may assume, is simply a worship of the ghosts of human ancestors, who, through the influence of language or some other causes, came to be mistaken, some of them for animals, plants, mountains, seas, sun and moon, while others grew in time to be the gods, the divinities of their race, it will be shown that there is no such ancestor-worship as that in America. There is an ancestor-worship, however, which is universal, and which I believe can be demonstrated by the mythology of every race on earth, if that mythology is only interpreted faithfully, and if we arrive at its inward and true thought.

"There is an ancestor-worship in America which is the worship of elemental or nature powers, which, as animals or in their own names as powers or objects in nature, are the myth-persons, the totems, or non-human ancestors, of the North American Indians, — the protectors, the guides, the enlighteners, of those whom we call 'medicine-men,' but who, as represented by the best among them, were the sages and philosophers of their race. That there were such, we know from myths which they constructed, and which we have received from their descendants.

"This ancestor-worship is the worship of the various manifestations in nature which primitive people noted and named, in all cases having significance for them. They worshipped in detail, and mainly, though by no means exclusively, in its external aspects, that which the man of our day worships as one which acts not merely in the universe outside, but in his own breast, — that Power men of the highest civilization and of every creed call 'Father,' and say that they descended from it. The Indians say that they are descended from manifestations of that same Power, are the children of those manifestations. We say, 'Our Father who art in heaven, give us this day our daily bread.' They say in their fashion, and according to the most ancient and sacred utterances of their race, 'Our fathers, give us this day our food,' using the plural where we use the singular. The Indian, therefore, stands precisely on the same line as the most enlightened man of the nineteenth century; with this difference, that he is nearer the beginning of the line, and sees in detail the Power which we see in unity.

"The work already done by the Bureau of Ethnology is small, if compared with what remains to be done before we can have a science of mythology on clearly demonstrated and symmetrically arranged facts; but it is a very large and important work if compared with what preceded it, and it shows, as no other work has been able to show, the nature of the task before us. When we shall have completed our collection of myths in the leading, if not in all, the American linguistic stocks, and obtained all the possible variants of each myth, we can make our final contribution to the science of mythology, which can never be founded without the American contingent.

"If much remains to be done in this country, there is still more to be done in Europe Asia, and elsewhere. Lang, in his article on 'Mythology,' omits the mythologies of the Celts and Slavs because so difficult and so little known. Now, the Celts are remarkable for the great extent of their recorded mythology, which has extended largely into English and other national literatures of Europe, though the fact is not generally known. Chaucer and Spencer have drawn much from Celtic sources. King Lear, Queen Mab, and other Shakspearian characters, are Celtic; and, if we consider the efforts made to destroy their language, the Celts of Ireland have a great number of living myths. The Slavs, though they have very few myths of ancient record, have within the territory they occupy more myths still existing in the minds of the people than all the rest of the nations of Europe taken together.

"Of Hindu mythology, little is known outside the Sanscrit, which, though extensive beyond any known mythology on record, has not been utilized to an extent at all commensurate with its value. The rest of Asia is practically unknown. Chinese mythology is as a sealed book; and it must have immense treasures with its so-called 'ancestor-worship,' the origin of which is undoubtedly misunderstood. I have said that we must obtain the complete mythologies of each linguistic stock of America, and we must work until we have shown what the characters of the myths of each stock really represent. This done, each stock is to be compared with that most nearly related to it, and then a general comparison of all. The final result will be a scientific American mythology. If the Aryan field is worked in a similarly careful manner, we shall have a complete Celtic, Teutonic, Greek, Slavonic, Persian, and other mythologies, and, finally, Aryan mythology as a whole.

"There still remain Africa, Australia, and the Pacific Islands, where there are materials of the highest value for the completion of mythologic science and the history of the human mind, — materials which are perishing every day, and which will never be collected if missionaries and travellers are to collect them. You could no more make a collection of myths through the agency of missionaries and travellers than you could make a geological survey of the United States if you depended on the voluntary and intermittent efforts of missionaries and travellers, some having, but most not having, definite ideas about geology or topography.

"Though mythology is as nothing on Wall Street in comparison with geology, the time, I think, is coming when a good number of men will place it higher; because mythology is to the history of the human mind what geology is to the history of the earth, — documentary evidence of the character of its different epochs. Even now there are few persons who would say that the earth on which he treads is better than man. You remember the words of the great poet, —

"'The cloud-capp'd towers, the gorgeous palaces,
The solemn temples, the great globe itself,
Yea, all which it inherit, shall dissolve,
And, like this insubstantial pageant, faded,
Leave not a rack behind.'

"When that time comes, it will be found that the only real, the only permanent, results achieved on earth were those relating to the human mind."

SCIENTIFIC NEWS IN WASHINGTON.

Phonographs, Graphophones, etc.; Curious Experiments with Jets of Water. — Replenishing Rivers with Shad. — More about the Water-Spouts. — United States Fish Commission Work on the Pacific Coast.

Instruments for Recording and Reproducing Speech.

Prof. Alexander Graham Bell read, at the last meeting of the Fortnightly Club, a paper upon recent inventions for recording and reproducing speech, exhibiting, to illustrate what he said, some of the latest and most curious devices that have been produced. He explained the nomenclature of the subject as he thought it ought to be used, by saying that a phonograph is an instrument for making a record of speech; phonogram, the record so made; and graphophone, an instrument for reproducing speech from a phonogram. In some cases the phonograph and graphophone are the same in most of their parts, but in many they are entirely different.

Professor Bell exhibited the graphophone, of which a number are now in practical use, and which, in its essential parts, is similar to Edison's phonograph. The record is made on a cylinder covered with wax or paraffine, and the speech is reproduced by conducting the sounds to a diaphragm connected to an open trumpet-shaped instrument, or, by wires to devices placed upon the ears, vibrations corresponding to those that were produced when the record was made.

A modification of these instruments was shown, in which the record was made upon a pasteboard disk revolved upon a shaft in a horizontal plane. The upper surface of the disk is covered with wax, upon which a similar impression to that on the wax-covered cylinder is made by a stylus connected with a diaphragm which is caused to vibrate by the sound of the voice. The record is a spiral groove cut in the wax. The reproduction is obtained in a manner similar to that used in the cylindrical machine. The principal advantage which this form of the instrument is expected to present over the older, cylindrical form is in the greater facility of multiplying copies. Electrotypes are much more readily made from the flat disks than from the cylinders. From these electrotypes other disks covered with wax, and that with tinfoil to prevent sticking, obtain the spiral impression by pressure of the former upon the latter; and when one of these duplicates, the tinfoil having been removed, is put into the instrument, the reproduction of speech is as perfect as from the disk on which the original record was made.

The most interesting and curious part of Professor Bell's paper related to experiments based upon investigations and discoveries made by Dr. Chichester Bell in regard to the effects of sounds upon jets of fluid. It is well known that if a jet of fluid, like water, is placed in sound-waves, it is not only sensitive to them, but it reproduces them as the string of a musical instrument, tuned in unison with that of another, will vibrate, and reproduce the tones given out by the first. It is not easy to hear the sound or speech reproduced by the jet of water. The former mode was to connect the hearing-tube with a rubber diaphragm placed in the jet of water, which is discharged perpendicularly from above, at a given pressure, from a very small orifice. When the rubber is held very close to the orifice, the sound reproduced is very faint; but, as it is moved away, it increases in volume until the point of maximum loudness is reached; then it diminishes again until near the point where the stream begins to break; and then it is broken up, and is entirely unintelligible. As the sounds to be reproduced by the jet have to be made in the same room, and very near to the jet of water, it is very difficult for any but a practised ear to detect the one from the other.

In order to make this more satisfactory, Dr. Chichester Bell made the following experiment. Substituting two platinum wires for the rubber diaphragm with a small piece of some non-conducting substance inserted between their ends, he placed this in the jet at the point where the largest volume of sound has been found to be reproduced. These wires being connected with an electric battery, and a telephone placed in the circuit, it was possible to have the speaker and listener almost any distance apart. With this apparatus, speech was not only reproduced, but with increased volume: the jet of water not only spoke, but acted also as a microphone to magnify the sounds it made.

Upon these experiments were based those which Professor Bell explained to the club. The jet of water, somewhat colored, was discharged upon a glass plate placed in it at the point from which the greatest volume of sound was known to issue in reproducing speech. This caused the jet to spread out in a thin film over the plate. The under side of the glass was covered with an opaque substance in which there was a small slit through which a small amount of light could pass. Behind the slit a moving piece of photographic paper was placed, upon which the record was made. Then a person spoke over the plate, and the result was a very curious line upon the photographic paper. When this line was transferred to gelatine in the ordinary way, it was found that a series of elevations and depressions was produced, which could be felt with the fingers, and from which an electrotype could easily be made. This showed that the sound-waves, striking the film of water on the glass, caused constant changes in the thickness of the latter, and thus caused a variation in the intensity of the light that passed through the slit. From such a record as this, it will probably be a simple problem to reproduce the speech. Professor Bell exhibited specimens of the original record upon the photographic paper, of the negative that is made for the transfer to the gelatine, and of the gelatine after the transfer had been made. The possibility of developing from these experiments an instrument for the reproduction of sounds that may be superior to any yet made is what makes them so interesting.

Shad-Hatching.

The shad-hatching by the United States Fish Commission this year is confined to four stations, — one at Fort Washington, on the Potomac; one at Havre de Grace and another at Battery Island, on the Susquehanna; and one on board the 'Fish hawk,' on the Delaware. The season for taking eggs will continue until the last week in May or the first week in June; and the number of eggs captured this year up to May 19 was far greater than had been taken at the same stations at the corresponding date of 1887, when the whole number for the entire season was more than 200,000,000. The three rivers are now yielding from 12,000,000 to 15,000,000 eggs daily. The commission is also giving attention to the moving of eggs and the hatching and planting of young shad in the rivers that flow into the South Atlantic and the Gulf of Mexico: 30,000,000 eggs will be disposed of in this way this season.

Whatever opinion may be held of the other work of the United States Fish Commission (and the importance of all branches of its work is coming to be universally recognized), its success in increasing the supply of shad in the rivers to which it has given its attention, and in introducing it where it did not before exist, has been demonstrated beyond question. The value of shad taken in the United States in 1887 was $325,000 greater than in 1880, and this in spite of the fact that the market-prices of the fish are now much lower than formerly. Shad can be bought on the wharves in Washington for from ten to twelve dollars per hundred, and at retail in the market for twenty-five cents each. Before 1884 the retail price of similar fish was seventy-five cents each. The increase first became noticeable in 1884.

The Water-Spouts of April.

Science republished, about six weeks ago, one of the charts of the Hydrographic Office, showing the location of a great number of water-spouts observed in the western Atlantic in March and early in April. Since that time many more detailed reports have been received; and among them one of the most interesting is that made up from the log of the steamer 'Pavonia,' and from the testimony of eye-witnesses who were on board of her. The following is the substance of that report. The spout formed south-west of the ship, and travelled in a north-east direction, making it necessary for the 'Pavonia' to change her course in order to avoid it. Its movement was at the rate of thirty miles an hour; and from the time it was first seen, until it burst near the vessel, only ten minutes elapsed. Its rotary motion was against that of the sun. The agitation of the sea at the base was tremendous, so that the ship was greatly affected by it when the water-spout passed near. The wind at the time was a light breeze from the south. As the water-spout passed, the ship experienced a perfect whirlwind for about a minute. The water-spout broke off the starboard bow, and this was accompanied by a great deluge of rain, vivid lightning, and heavy thunder; and chunks of ice fell upon the decks of the 'Pavonia,' irregular in shape, as though broken from a block, many of them from four to six inches in diameter. As the water-spout broke, the wind shifted to the south-west, and increased to a moderate gale. The cloud hung very low, and the water-spout took the form of an hour-glass. A terrific roaring noise was heard as it passed the ship, and, as it went along, it threw the water to a height of sixty feet at least, and churned it up into a mass of foam. There was no evidence of ascending or descending currents. The water appeared to be lifted bodily into the air, and held there until the water-spout broke near the vessel. No observations of barometer or thermometer were made.

United States Fish Commission Work on the Pacific Coast.

The United States Fish Commission steamer 'Albatross,' Capt. Z. L. Tanner, arrived at San Francisco last week, and, as soon as she is fitted out, will start on her summer cruise. She has been ordered to cruise from Kodiac to and along the Aleutian Islands, for the purpose of studying the fishing-grounds of the Alaskan coast. The most important fish found there is the cod. Captain Tanner is instructed to make a careful and systematic study of the whole coast, not only hydrographically, but for the purpose of determining the kinds of fish to be found there, the limits of their distribution, and their abundance. He is also to make a thorough study of the fauna of the sea and its distribution over the sea-bottom. Important results are anticipated from this summer's cruise of the 'Albatross.'

ELECTRICAL SCIENCE.

Edison's Improved Phonograph.

THE first phonograph made by Edison, in 1878, differed from many inventions — for example, the telephone and telegraph — in that it was not the result of a process of evolution, and it was not almost simultaneously discovered by different investigators. As it was first exhibited, it consisted of a diaphragm to which was fastened a needle whose point pressed against a strip of tinfoil: the tinfoil was rolled around a cylinder, which was rotated by hand, and which had, besides its motion of rotation, a forward motion on a screw, so that the needle traced a spiral on the surface of the foil. When the diaphragm was spoken to, the cylinder being at the same time turned, the needle made a record on the foil; the number and depth of its indentations depending, of course, on the vibration of the diaphragm, and therefore on the sound it received. When the needle was made to traverse the record again, it transmitted vibrations to the diaphragm similar to those it had received, reproducing the original sound. There were several disadvantages in this first instrument: the reproduction was by no means perfect, and the mechanical arrangement was not convenient. Mr. Edison has, however, continued his investigations on the subject, and has lately produced an instrument that leaves little to be desired as far as faithfulness of reproduction goes. There is no radical change in principle. In place of the tinfoil, wax cylinders are used, and they are uniformly rotated by an electric motor. The instrument is so arranged that words can be repeated that are not understood. The wax cylinders are of different sizes. One of two inches in diameter, four and a half inches in length, and one-eighth of an inch thick, will contain from one thousand to twelve hundred words, and can be used over ten or twelve times, a turning-tool in front of the diaphragm shaving off the old record. The accuracy with which sounds, vocal and instrumental, are reproduced is remarkable. On May 12 an exhibition of the phonograph was given at the New York Electric Club, and Mr. Gilliland described the history of the invention. Various applications were shown, and a number of different sounds reproduced. There is no doubt that the phonograph can accurately record all varieties of sound, from the human voice in ordinary conversation to a brilliant piano concert. The records are portable and easily reproduced, and the field of application of the instrument must be wide.

DYNAMO AND STEAM TURBINE. — A combined dynamo and steam turbine that has been in use in England for some time, has recently been introduced into the United States for ship-lighting purposes by the United States naval authorities at Newport, R.I. The armature of the dynamo is connected directly to the shaft of the turbine, which revolves at the extremely rapid rate of ten thousand revolutions per minute. The turbine works on the general principle of Helmholtz's double siren, except that instead of two disks there are perhaps fifty, arranged on horizontal axes; the steam entering at the middle, and exhausting at the ends. While this is in all probability not economical, it is extremely compact, — a very important consideration on board ship, where space is valuable and belting is objectionable. The electro-motive force of the dynamo is kept constant by an electric governor which regulates the throttle valve of the turbine. The extremely high speed necessitates the best possible lubrication: the bearings are long, with ample oil-channels.

PRIESTMAN'S PETROLEUM-ENGINE. — The London *Electrical Review* contains reports of tests of this engine made by Sir William Thomson, Sir Samuel Canning, and others. The reports are most flattering. Tests were made of engines giving six-horse power at the driving-pulley, with the result that the consumption of oil was about 1.7 pints per horse-power per hour, while they need very little attention. To quote a part of Sir Samuel Canning's report: "We consider that there is a great field of usefulness for this motor, and especially in America, where gas averages something like 7s. 6d. per thousand cubic feet, and where, owing to the vast expanse of the country, it is very difficult to get motive power in more or less inaccessible localities; . . . for isolated electric light installations, and even larger operations of the kind, and for every use to which a gas-engine can be put, with the special advantage of being capable of employment where gas cannot be utilized." The engine is run by the petroleum vapor, which is exploded in the cylinder, as is the gas in the cylinder of a gas-engine. There must, of course, be a water-jacket to the cylinder, to prevent excessive and dangerous heating. Let us consider what the cost of isolated lighting would be, using this engine, as compared with gas. An ordinary gas-burner uses over six feet of gas per hour: one mechanical horse-power at our oil-engine can supply twelve corresponding incandescent electric lights; or 1.7 pints of oil must be compared with 72 feet of gas; roughly, 24 pints of oil will equal 1,000 feet of gas. The quality of oil used cannot cost as much as ten cents per gallon: at that price the oil for our engine will compare with gas at thirty cents per thousand. To this we must add about fifteen cents for breakage of lamps, making forty-five cents per thousand. The amount to be added for interest and deterioration depends entirely upon the amount of light used: for an ordinary household, using four or five thousand feet of gas a month, this item might amount to a dollar a thousand at a very liberal estimate, making the total cost one dollar and forty-five cents a thousand at the outside, and giving all the advantages that incandescent lighting offers, — greater health, convenience, comfort, and beauty, with the use of small motors for various domestic purposes.

ACCUMULATOR TESTS. — The London *Electrician* contains the following: "Prof. von Waldenhofen has recently carried out at the Electro-Technical Institute a comprehensive series of experiments with the storage-cells of the Fahrbarky and Schenck, Reckenzaun and Julien type. The chief object of the experiments was to ascertain the efficiency of each type, especially for tramway purposes, and to eliminate errors in estimating the degree to which the cells had been charged or discharged. The experimenter based his investigation on three measurements; viz., the electro-motive force on open circuit, the density of the electrolyte, and the potential difference when at work. The efficiency of the Reckenzaun accumulator was found to be 89.3 per cent for quantity, and 80.5 per cent for energy. For the Julien accumulator, the figures were respectively 89.7 per cent and 83.4 per cent; whilst the Schenck-Fahrbarky accumulator gave 91 per cent efficiency for quantity, and 78.5 per cent for energy." These figures are interesting; but as the efficiency of any accumulator varies greatly with the rate of discharge, decreasing as the discharge rate increases, it would be well to give with the efficiencies the rate of discharge at which they were obtained. As the experiments were for tramway-work, however, we may assume that rather heavy currents were used: this being the case, the tests are most encouraging.

THE BENTLY-KNIGHT ELECTRIC TRAMWAY IN ALLEGHENY CITY. — This line is about four miles in length, and employs both overhead conductors and conduits. In both cases there is a complete metallic circuit, neither the rails nor earth being used as a return. The road is difficult, with one grade of 9¾ feet in 100 feet for a distance of 400 feet, and numerous others; the average rise in a distance of 4,900 feet being 295 feet, — over six per cent. Two fifteen-horse power motors are used under each car, connected with the axles by spur-gearings. There are at present four cars running, with two more to be added shortly.

HEALTH MATTERS.

State Medicine.

AT the meeting of the American Medical Association held in Cincinnati during the present month, Dr. H. P. Walcott, chairman of the State Board of Health of Massachusetts, delivered the annual address on State medicine. For the following abstract of the address we are indebted to the *New York Medical Record*: —

Dr. Walcott first related briefly the history of the State Board of Health of Massachusetts, which was established by legislative action in 1869. Its duties were at first advisory rather than executive; but, in proportion as public intelligence in sanitary matters was quickened, the functions of the board were enlarged, until now it is charged to some extent with the power of enforcing the rights of the people to pure air, soil, water, and food, and preventing and punishing any violation of them. It is also intrusted with the business of gathering information concerning any matter pertaining to public health, and diffusing such information among the people. Among the chief of its duties in this connection is the investigation of the causes and the prevention of infectious diseases. A comparison of the mortality statistics will show in a measure the effect which all this work has had upon the health of the people. The number of deaths from all causes, in proportion to the population, has changed but little during a period of thirty-six years, ending with 1886; but the percentage of deaths from zymotic diseases has almost steadily decreased, during the period that the State Board has been in existence, from 25.6 to 19.0; there has also been a general tendency, though less marked, in the direction of a decrease of deaths from constitutional diseases. The classification of preventible diseases is as yet not well defined; and year by year, as the experience of sanitarians becomes widened, a larger and larger number of affections are found to be the result of influences that can be removed. This fact is illustrated in the case of consumption, the prevalence of which was shown twenty-five years ago by a former president of this association, Dr. H. G. Bowditch, to be largely influenced by conditions of soil, moisture, and land-drainage. The most marked reduction has occurred in the case of small-pox, which is a disease that is absolutely preventible by means of vaccination and re-vaccination. In demonstration of the saving of life in consequence of better sanitary conditions, the speaker offered a comparison between the results of ovariotomy and those following the labors of an intelligent and efficient board of health. The largest number of deaths in Massachusetts in any one year from ovarian dropsy was 51. In the single city of Somerville the death-rate has been reduced, since the organization of a municipal board of health, from 22.86 to 16.68 per thousand. Thus the adoption of sanitary measures has saved more lives in one year, in a community of thirty thousand people, than could have been restored to health in the same period in a State of nearly two millions of inhabitants, by an operation which is justly regarded as one of the greatest triumphs of American surgery. In has been said by Dr. Russell of Glasgow that nothing is more conspicuous than the helplessness of the individual, under the conditions of civilized life, to secure the physical basis of health. How can any single individual in a crowded city detect and remove all possible causes of disease in the water, food, sewerage, and air contamination? There is no help but in co-operation on the most extended scale possible, — individual, municipal, State, and national. The individual must be compelled to give up the liberty to injure his neighbor; the city must be restrained from converting into a sewer the river which supplies water to the villages that cluster about its banks lower down in its course; no State should permit its own causes of disease, whether they are persons or things, to be transported into another State; lastly, the general government should take cognizance of those causes of disease which can be controlled by no other power. A sufficient safeguard will never be established by voluntary associations on the part of persons, towns, States, or even nations. How, then, shall we organize for the protection of the public health? For the individual, the speaker maintained: "Let the State give him some assurance that the legally used title of physician designates a person sufficiently qualified to give advice for the prevention and cure of disease; establish, by direct provision of State law, local health authorities for each village, town, city, or county; and, to control all these local organizations, let there be a State board, clothed with ample powers." All arguments that have been used for the existence of State health authorities, Dr. Walcott believed, are also available for the creation and support of some central health authority. The question of form of this organization is one that may be left to the law-making powers. A board in which every State was represented might be cumbersome, but it could easily delegate its powers to a small and compact executive committee during the intervals between the necessarily infrequent meetings of the full board. The only alternative to this seemed to the speaker to be a single officer at the head of a bureau in connection with some one of the departments at Washington. This central authority, however constituted, should have ample means for investigating into the State boards of health. There is still in legal existence a national board of health; but, through the neglect of Congress, it is in a state of hopeless lethargy. This board entered upon its work with every promise of success, and it demonstrated that local, State, and national health authorities could profitably and harmoniously unite in suppressing an epidemic of yellow-fever, and preventing its spread from State to State; yet this did not save it from practical extinction. The failure of the board to survive the unjustifiable attack made upon it was due in great measure, the speaker thought, to its organic form, embracing, as it did, members of the army, navy, and marine-hospital service, and having a totally insufficient State representation.

In conclusion, Dr. Walcott urged the proper organization of some central health authority, whether in the form of a bureau of health or a board of health; provided, only, that some part of the great resources of the nation might be turned to the protection of that greatest of all property, human life. The address was referred, with the thanks of the association, to the Committee on Publication, from the section on State medicine.

Too Many Medical Students.

The president of the American Medical Association, Dr. A. Y. P. Garnett of Washington, took for the subject of his presidential address 'The Mission of the American Medical Association.' Its paternal relation to the entire profession of the United States imposes upon it duties and responsibilities of the gravest character. He said: "Taking a retrospective view through nearly half a century of existence, we have no reason to be discouraged. But, while we feel gratified by contemplation of the fruits of our labor in the past, it is obviously important that we should not be flattered into a belief that we have accomplished our mission, and permit ourselves to lapse into supine indifference with regard to a pre-eminently important object which remains to be worked out through the instrumentality of this association. I refer, gentlemen, to radical and thorough reform in the present system of medical education in the United States." He submitted the following propositions: —

"*Proposition First.* That a standing committee, to be called the Committee on Legislation, shall be appointed for each State and Territory, and the District of Columbia, to consist of five members of the medical profession in good standing, three of whom shall have no official connection with any medical school or college, whose duty it shall be to carry out, as far as possible, the following instructions:

"*a.* Each one of said committee, or a majority thereof, shall attend the sessions of their respective Legislature from time to time, as their duties may require, for the purpose of using all honorable means looking to the reduction of medical schools in the United States, and the consequent diminution of the annual number of graduates; that, as a practical measure to this end, they urge the passage of a law requiring that in the future granting of charters for creating medical schools there shall be a clause in every such charter requiring that all schools or colleges thus created shall demand a full term of four years' study before granting a diploma thereof, and that no student shall be admitted to matriculate who has not passed satisfactory examination, oral and written, in the ordinary branches of academic study; and, further, that any college failing to show a greater number than fifty matriculates annually for three consecutive years shall forfeit its charter and be abolished.

"*b.* That they use all diligent efforts to secure an ordinance creating in each State and Territory where no such board at present exists, and in the District of Columbia, a board of medical examiners, which shall have no connection with any medical school, and which shall be required to examine all applicants for license to practise medicine in the States, Territories, and the District; and that any person who may be detected practising any branch of the healing art without a license granted by the said board shall be subject to such penalties as the law may provide.

"That this committee may be authorized by statute to select and nominate to the governors of the States, Territories, and the District of Columbia, seven competent learned members of the medical profession, to constitute such a board of examiners, who shall have exclusive power to issue licenses to practise the art and science of medicine and surgery.

"*c.* That the chairman of the said committee of five be required to submit at each annual meeting of the association a report embracing a full statement of what has been accomplished by each.

"*Proposition Second.* That the faculties of the several medical schools within the limits of the United States be once more urgently requested to call a convention at some central point for the purpose of consultation and adopting some general and uniform system of medical education, more comprehensive and rigid in its requirements, and more in accord with the spirit of the age and advanced progress of medical science, suggesting four years' term of study, the requirements of a preliminary education including some knowledge of the classics; that any college or school which shall refuse to enter into such arrangement as may be decided upon by the said convention shall be excluded from all connection with the American Medical Association, and its alumni shall not be recognized as members of the regular profession."

OLEOMARGARINE IN MASSACHUSETTS. — The Legislature of Massachusetts has passed a law prohibiting the sale of oleomargarine in that State. The State Board of Health advised the Legislature against the passage of the bill, holding that oleomargarine was not injurious to health.

THE TYPHOID BACILLUS. — Another epidemic of typhoid-fever has been traced to infected drinking-water, the typhoid bacillus having been discovered in the water. The outbreak occurred in a boarding-school at Quimper, France, one-sixth of all the inmates being attacked, and one in eleven dying.

THE NUMBER OF MEDICAL STUDENTS. — The *British Medical Journal* gives the following as the number of medical students in the following universities in the winter session just elapsed: in Vienna, 2,287; Munich, 1,369; Berlin, 1,316; Würzburg, 956; Leipzig, 794; Prague, 566; Graz, 501; Griefswald, 471; Breslau, 382; Freiburg, 350.

MENTAL SCIENCE.

Reflex Speech.

ACTS performed at first with great effort, by constant repetition become so thoroughly ingrained in the nervous system that they are performed without the slightest effort, or even may be performed in spite of a more or less strong effort to resist them. When this occurs, an originally voluntary act is said to have lapsed into the automatic or reflex stage; the act has become mechanical; and pressing the proper key will produce the appropriate re-action. In a recent issue of the *Journal of Mental Science*, Dr. G. M. Robertson calls attention to the fact that there exists a large number of colloquial phrases that have become automatic. Speech, though at first learned with great difficulty, becomes the most natural channel for expressive movements. We are daily asked, "How are you?" and as frequently reply, "Very well, thank you." And the best proof of how very automatic and unreflective this answer is, is given by the innumerable cases in which this is said even when we are not well. This is present in a perfectly healthy mind, but it remains obscured. When we are excited or confused, or, better still, absent-minded, the phenomenon becomes more prominent. Ask an absent-minded friend, "How are the family to-day?" or "How is your brother Tom?" and he tells you, "They are well, thanks;" and immediately adds, "What *have* I been saying? Why, my father is laid up with gout," or "Tom has broken his arm."

All reflexes are controlled in health, but appear in exaggerated forms in disease. This speech-reflex becomes very marked in dementia, where there is a gradual breakdown of the mental structure, and, as is the universal law, the highest, least stable products are the first to decay. The power of intelligent speech is lost or enormously reduced, but the more deeply acquired habit of automatic responses is retained. One such demented patient showed practically no intelligence: he never even asked for food or drink. He underwent a severe surgical operation without saying a word, but his reflex speech was preserved. Here are samples of it: "How are you?" — "Oh, just about the ordinar', thank ye." — "How are you feeling to-day?" — "Oh, pretty weel, thank ye." — "How's all with you?" — "I'm doin' pretty weel." — "You're not so well today?" — "I don't think I am." — "How's the wife this morning?" — "Oh, she's very weel, I'm thinkin'." — "Will you take your hands away?" — "Yes, I'll do that." Intelligent though these answers seem, they were not so; for he was all the while suffering from a serious illness, he knew nothing about his wife, and, though he promised to keep his hands away, he did not do so.

Another patient named Ross, though chattering all day, had really no intelligent speech. Within a minute he would say such incoherent nonsense as, "If you would just come be! Oh, dear, dear! Oh! that is the whole clash. That's what! Oh, dear, dear me!" and so on. The only phrase with meaning here was "dear me!"—a reflex phrase. But in such simple talk as the following, Ross could take a part: "Well, Ross?"—"Weel, sir."—"How are you?"—"Very well, sir."—"It's a fine day, Ross."—"It is that."—"Ross?"—"I hear, sir."—"You're not well to-day?"—"Oh! I don't know."—"Good-by, Ross!"—"Good-by, sir!" The attendant could not get a sensible word out of him, and was much surprised to hear how well the patient could talk to Dr. Robertson, neglecting to notice that the latter was careful to ask for reflex phrases.

In some cases the answers will not be appropriate to the query. "It's a rainy day," will be answered by, "No, I'll no do it;" "What day is this?" by "Oh! but that is not right;" and so on. From his study, Dr. Robertson concludes (1) that actions seemingly intelligent may be mainly automatic, or reflex; (2) that in speech we have present all the causes leading to a reflex action; (3) that in health such speech-reflexes are exhibited, but under special circumstances they come into prominence; (4) that in some forms of mental disease this reflex is exaggerated; and (5) that the path of reflex speech is well organized, and strongly resists destruction.

RE-ACTION TIME FOR TEMPERATURE AND TACTILE SENSATIONS.—M. v. Vintschgau and E. Steinach (*Pflüger's Archiv*, xliii. 2324) have made a very extended series of experiments upon the time necessary to perceive the contact of an object on the skin, as well as the time necessary to feel a cold and a warm object. They have improved the method of making such tests, and the times they report agree well with those of former workers. They summarize the results of their work thus: finely sensitive portions of the skin, such as the cheek, have a greater re-action time than portions of less sensitiveness; differences of 2° to 4° C. in the temperature of the stimulating object do not influence the time of re-action; repeated cold applications diminish sensibility for cold, and lengthen the re-action times for cold; increase of bodily temperature does not increase the sensibility for warmth, nor decrease the re-action time; the time necessary to perceive warmth as well as cold on the hand is longer than on the face; an impression of warmth or cold is more quickly perceived if applied to the right side of the face than to the left; it takes longer to perceive a sensation of temperature than one of simple pressure, and longer to perceive warmth than cold; indisposition lengthens the re-action time for pressure.

AN INSTRUCTIVE CASE OF WORD-DEAFNESS.—Dr. Bianchi has recently described (*Revue Philosophique*, March, 1888) a case of this peculiar trouble that beautifully illustrates the relative independence of the several sensory factors of language. Our language consists primarily of a receptive power of hearing and understanding words, and an expressive power of articulation. To this is added, at a later period, the receptive power of seeing and understanding printed characters, and the expressive power of writing. Disease may deprive one of the use of any one of these four factors, leaving the others almost intact; while the probability of the loss of the one bringing with it the loss of the other depends on how independently each has been cultivated, and on individual differences. A person who writes little, and has to translate spoken into written language, will probably lose the power of writing with the power of speaking; but one who is accustomed to have his thoughts flow off the tip of his pen may retain this power when he becomes aphasic. Dr. Bianchi's case is that of an intelligent young merchant who was stricken with paralysis, and, after recovering from his attack, was found unable to understand words. His intelligence seemed unimpaired. He appreciated that he was spoken to, and appealed to a bystander to answer for him. He could appreciate and make himself understood by gestures. He could hear a watch ticking at quite a distance, and was in no way deaf. He never spoke. If his name, 'Arthur,' was shouted to him with the gesture that he was to repeat it, he did so in parrot-fashion, but evidently without appreciating that it was his name. By thus teaching him syllable by syllable, he learned to say, "*Buona sera!*" ("Good-evening!") and said it on all occasions, whether appropriate or not. He was similarly taught such words as 'bread,' 'water,' and so on. He could write, but apparently only under dictation. If you placed a pen in his hand, he would write words without meaning; but if asked the question, "From what country are you?" he would write, "From what country." At first he was totally unable to understand what was written, but he was gradually taught to do so, though he could not read the words he had been taught to speak.

THE 'VISUAL AREA.'—One of the main points of discussion between Ferrier and his opponents is with reference to the location of the sight-centres in the cortex of the brain. Ferrier places it in the angular gyrus, while others maintain that it is localized exclusively in the occipital lobe. Dr. Schäfer has repeated these experiments on dogs and monkeys (*Brain*, 1888), and found the centre to be entirely in the occipital lobe. Moreover, the centre of each hemisphere is connected with half of the retina of each eye. He explains Ferrier's results by an injury to the fibres running beneath the angular gyrus to the occipital lobes. These results bring pathological and experimental evidence into agreement. Dr. Schäfer did not find, as Ferrier claims, that injury to the temporal lobes caused deafness, but was able to support by a single case Ferrier's localization of the sensations of touch in the *gyrus fornicatus*.

BOOK-REVIEWS.

An Elementary Geography of the British Isles. By ARCHIBALD GEIKIE. London and New York, Macmillan. 24°. 30 cents.

THE present little volume is the first of a series of geographies which the author is about to publish, in accordance with the principles laid down in his admirable book 'The Teaching of Geography.' The text-book contains carefully selected facts which will not overburden the memory of the child. Each place, each town, and each hill is mentioned in connection with some historical fact or physical phenomenon. This will prove a help as well for the teacher as for the child. The author emphasizes rightly that a text-book can be no more than a guide to the teacher and to the learner, and he assumes that the former will use the facts and hints presented in this book according to the principles set forth in his discourse on the 'Teaching of Geography.' Thus the present volume is an exemplification of the former; and we imagine a teacher who will use both together will find the study of geography one in which the pupils take the greatest interest, and from which they derive great benefit regarding their powers of observation, and love of nature. We may mention here incidentally the interesting scheme of the Scottish Geographical Society, undertaken in part at the instance of Geikie. Schools are invited to examinations in geography, and the examination-papers are drawn up so admirably that they will have a great influence in remodelling the methods used in Scottish schools. We recommend a perusal of the results and methods of the examination, which are published in the May number of the *Scottish Geographical Magazine*, to teachers of geography. We take exception only to one point in Geikie's method. It is the introduction of far-reaching anthropogeographic theories in elementary teaching. It seems to us that these theories have not sufficient meaning and foundation, without a knowledge of certain psychological and historical facts, to be of much use to a child.

Society in Rome under the Cæsars. By WILLIAM RALPH INGE. New York, Scribner. 16°. $1.25.

THE present volume is a concise and useful review of the manners and customs of the Romans at the time of their greatest power, and will be read with great interest by all who have no leisure to study the works of Friedländer and others, from which Inge's book is a compilation. The author has arranged his material well, and presents it in a very readable form. Religion, philosophy, and morality occupy the first place. Then follows a short chapter on the social influence of imperialism in the first century. Literature and art, as well as the social organization and the daily life of the various classes, are fully described. The book does not claim to give any new results. The essay obtained the Hare Prize at Cambridge in 1886. It may be recommended to all who take an interest in the history of civilization, treating, as it does, in an adequate form, one of the most remarkable chapters of the history of mankind.

Stieler's Hand-Atlas. Gotha, Justus Perthes. f°.

IT is now six years since the last edition of this great work has been issued. Since that time the commercial development of certain regions, and the additions to our knowledge of others, have been so great, that the atlas did not meet the demands of the day: therefore the new edition, the first instalment of which has just been issued, is highly welcome. It is hardly necessary for us to dwell upon the fact that the technical execution of the maps is artistic and accurate. In the last edition of the atlas a few of the older plates, which were somewhat worn, and not as perfect as the newer ones, were retained; but these are now altogether eliminated. We consider it a great improvement of the maps, that the shading all along the coast which is intended to show the water has been discarded, and that a delicate blue tint has been introduced instead. The first instalment contains two new maps, — one sheet of the new four-sheet map of Italy, and one of the four-sheet map of Austria. The relief of Italy is presented here for the first time in an atlas in a clear form, and, what is more, representing the real configuration of the land instead of the old conventional forms. It is founded upon the surveys of the Italian Department of War, which are rapidly being pushed forward. In order not to disturb the impressiveness of the physical features, the railroads are shown as formerly projected roads were generally shown.

The first sheet of the map of South America may serve as an example of the care with which corrections have been made on the old plates. The sheet embraces north-eastern Brazil and French and Dutch Guiana. The interior of the Province of Pernambuco is entirely new, the northern tributaries of the San Francisco being for the first time shown in their real form. While the old maps showed a series of hills running from north to south, we observe now a well-defined ridge forming the watershed between the provinces of Pernambuco and Ceara. In other places, rivers which were shown in solid lines on the old maps, are shown in broken lines on the new ones, indicating that our knowledge is not so complete as was formerly assumed. We observe this particularly in the province of Grao Pará; and farther up the Amazon we see, to our surprise, the course of the Rio Trombetas entirely changed, although it was thought that its course was well known. The administrative boundaries of the provinces of Brazil have also undergone important changes.

The atlas, when complete, will contain ninety-five sheets; the map of the moon, and a few general maps of the old edition, being left out in order to gain room for new detail maps. The following maps have been added to the atlas: two sheets showing the eastern portion of Austria, a four-sheet map of Italy, a general map of the Balkan Peninsula and four special maps of the same, a map of Africa in six sheets, and western Canada. Besides this, the maps of Germany, Austria, Denmark, and Asia Minor have been replaced by new engravings.

A Synopsis of Elementary Results in Pure Mathematics. By G. S. CARR. London, Francis Hodgson. 8°.

THIS volume of more than nine hundred royal octavo pages is a handbook which must be extremely useful to every one engaged in either teaching or applying mathematics. As its title implies, it is principally a collection of results, more especially of theorems and formulæ. For example, the section devoted to the integral calculus, which comprises more than one hundred pages, contains a complete synopsis of all the ordinary integrals, both definite and indefinite, with brief indications of the method of deriving them. The statements are models of condensation, being at once clear and concise. Especial attention seems to have been devoted to the typographical arrangement, which is extremely clear; the words, numbers, and formulæ which are first to catch the eye, and are principally to be used, being printed in large, bold type, while the indications to be subsequently examined are in finer type.

Notwithstanding the general excellence of the book, it seems susceptible of many improvements, both in its plan and in its details. It cannot displace the text-book, nor is it intended that it should: hence it would have been well to omit all matter for which the student would naturally go to his text-book, as well as that for which no book is needed. This is especially the case with the chapter on elementary geometry, and with large portions of the chapters on trigonometry, which might have been omitted or greatly condensed without diminishing the usefulness of the work. Notwithstanding that the brief demonstrations are concise in the extreme, many more are given than have any appropriateness in the book. In most cases it is only the result, and not the proof, which the person using the book will want, and when he does want the latter he will generally know where to find it. More space might, then, have been devoted to advanced subjects, which are not sufficiently developed.

In detail the defects are very numerous, considering the amount of labor and care which seems to have been devoted to the work. The astronomical and physical constants at the beginning of the book are so far from embodying the latest results as to be worse than useless to any one wanting precise values of constants. In the factor-tables it seems almost ridiculous to see a mathematician give *zero* as the smallest factor of a prime number. It should have been unity, if given at all; but Burckhardt's plan of indicating prime numbers by a dash is much more convenient. Among the subjects insufficiently treated are regular solids (no mention is made of sympolar relations), trigonometric series, and determinants. What is given of the calculus of variations might as well have been omitted entirely.

The term 'eliminant' being almost entirely replaced by 'resultant' in mathematical language, the former should not have been used to the exclusion of the latter. In Section 1628 an invariant is described as multiplied by the modulus of transformation, when in fact the co-efficient may be any power of that modulus. In Section 1637, Cor. 2, it is stated, that, if any quadric is resolvable into two factors, the discriminant vanishes. But this is not true of the binary quadric, which is the most common one.

We should naturally suppose that great care had been taken in the printing: it is therefore surprising to see in equation (4) of Gauss's trigonometric formulæ, p. 190, '$\cos \frac{1}{2} c$,' printed in bold type, instead of '$\sin \frac{1}{2} c$.'

These defects are not to be considered as materially detracting from the value of a most excellent piece of work, which should be welcomed by all teachers of mathematics. S. N.

NOTES AND NEWS.

ONE method of disposing of the surplus water of the Mississippi River that has been proposed has been to construct an outlet for the flood-water through Lake Boyne. Capt. S. S. Leach, Corps of Engineers, formerly secretary of the Mississippi Commission, explained to the Senate Committee on the Improvement of the Mississippi River, last Saturday, why this plan is not feasible; in fact, he characterized it as preposterous. He said that such an outlet would increase the velocity of the river at New Orleans by at least twenty-five per cent. Already it requires the best engineering skill to prevent the banks at that point from being washed into the river. If the velocity of the flow should be increased twenty-five per cent, he said, no expenditure of money would make them retain their place. Captain Leach also explained the plan upon which the Mississippi River Commission is now working. He estimated that a system of levees from the mouth of the river to the head of navigation, protecting all points that need additional protection, will cost three million dollars, and that thirty millions would be needed to establish a ten-foot channel through the same length of the river.

— The Hydrographic Office has received a number of reports of peculiar colorings of the sea, of which the following are the most interesting. The captain of the British steamer 'Kathleen' reports, that April 23, latitude 36° 25′ north, longitude 48° 10′ west, he passed through about five miles of discolored water. It had the appearance of sulphur floating on the surface. The captain of the American bark 'John J. Marsh' says, that April 27, in latitude 35° 34′ north, longitude 74° 50′ west, his ship passed through a patch of water as white as milk, the edge of which was distinctly marked, and which was not phosphorescent. The extent of it was about three miles in longitude and five miles in latitude. He found no bottom by sounding at thirty-five fathoms. The sky was clear, and the stars shone brightly, at the time. The officers of the British steamer 'Lero' report, that April 25, in latitude 35° 04, north, longitude 58° 16′ west, their ship passed through a wide field of discolored water, in patches, each patch being about one hundred yards long and two hundred yards wide. The water had an appearance similar to that over a shoal. That night the sea was remarkably phosphorescent, and the ship was evidently passing through the same kind of water.

— Capt. H. Parsell of the R. M. S. 'Britannic,' reports, that on April 12, at about 8 h. 17 m. 43 s., A.M., he observed a comet bearing east (true). The altitude of the nucleus was 15° 20′ 20″; eye, 33 feet; latitude 4° 24′ north; longitude, 68° 14′ west. He continued to observe it every night until he arrived at Queenstown. What was also probably the same comet is reported by Capt. E. W. Owens of the British steamship 'Iowa' as having been observed April 9 at 3 o'clock A.M. He was in latitude 40° 30′ north, longitude 36° west. The comet was seen bearing east, with its tail in a southerly direction. Its altitude was 15°. Local time was used.

— The proposed transfer of the Coast Survey from the Treasury Department to the Navy will probably be provided for at the present session of Congress. The Senate committee has already made a favorable report; and the sub-committee of the House Committee on Naval Affairs, to whom the subject has been referred, is understood to be favorable to it.

— The Senate, on Monday, passed a bill appropriating $17,500 for making the west end of the Smithsonian Institution building fire-proof. A citizen of the United States, who has long resided abroad, proposes to give to the Smithsonian Institution a large collection of armor from the middle ages, — some of it connected with most famous historical names, — including horse-armor, helmets, swords, and all the paraphernalia of ancient warfare. These objects, numbering about five thousand, have been collected at great expense, and the collection is one of the most valuable of the kind in the world. The condition of the presentation is that the Smithsonian Institution furnish a fire-proof building for its protection.

— Prof. Alexander Graham Bell will sail for Europe June 2. He has been invited to appear before the British Royal Commission now engaged in making an inquiry into the best methods of caring for and educating deaf-mutes. It may be remembered that several years ago Professor Bell presented a paper, at a meeting of the National Academy of Sciences, on the formation, through the intermarriage of deaf-mutes, of a deaf variety of the human race, and gave some important statistics to show that a much larger percentage of the children of deaf parents are deaf than of those whose parents possess the sense of hearing. This paper attracted wide attention, and gave rise to very interesting discussions both here and abroad. The Royal Commission has requested Professor Bell especially to give to it the results of his subsequent investigations and studies upon this branch of the subject, and he has devoted much time to the preparation of facts and figures in regard to it. He will also give the commission the result of his studies of other divisions of the subject.

— The summer session of the Chautauqua College meets at Chautauqua July 6. The college has two departments, — the summer session, at which only special work is done; and the correspondence department, which has a full college course, and works during the college term. The present session of the latter is just closing with four hundred and twenty students.

— At the meeting of the American Philosophical Society, May 4, Prof. C. V. Riley, the entomologist, called attention to some grave errors in the published minutes of the earlier meetings of the society. He remarked that the public, as well as the most competent authors, had always believed that the Hessian-fly — that pest of wheat-culture — was introduced during the Revolution by Hessian troops. Dr. H. A. Hagen of Cambridge has argued against this belief, and, further, that the species was not imported from Europe; one of his most potent arguments being that based on the early minutes of the Philosophical Society, which, as communicated to him (Hagen) by one of the secretaries, Mr. H. Phillips, jun., and as published, make mention of the Hessian-fly in 1768, or before any Hessian troops landed. The statement of the secretary, as also the published minutes, turn out to be absolutely erroneous on these points, as, upon consulting the original records, Professor Riley found no mention of the Hessian-fly prior to 1791. In all previous cases 'the fly,' or 'the fly in wheat,' or 'the fly-weevil,' are the terms used; and it is susceptible of positive proof that these terms referred to totally distinct insects, belonging to a different order, and still called the weevil, viz., *Sitophilus granaria* and *S. oryzæ*. It is a most interesting illustration of grave and misleading error, resulting from carelessness in what appear to be trifles.

— The thirteenth session of the Sauveur College of Languages will be held at the University of Vermont, Burlington, Vt., commencing July 9, and continuing six weeks. After the close of the last session of the Sauveur Summer College of Languages in Oswego, N.Y., it was resolved to hold the thirteenth session this year at Burlington, where they spent the summers of 1884 and 1885. The want of accommodations, which caused the college to leave there in 1885, has been supplied. Oswego treated the college in the most friendly manner from the first to the last day of their stay there. Yet there was missed something which Oswego, with its commercial bustle and activity, could not give; namely, the quiet, rural character of the former home at the foot of the Green Mountains.

— The Prince of Monaco is about to publish the scientific results of the cruises of the 'Hirondelle' in the Atlantic Ocean in a magnificent illustrated volume in folio. The work will be edited by the prince and Jules de Guerne, zoölogist of the expedition, while specialists have charge of the various departments. The prince invited correspondence with scientific societies and institutes for exchanging periodicals and marine or fresh-water specimens.

LETTERS TO THE EDITOR.

**** Correspondents are requested to be as brief as possible. The writer's name i in all cases required as proof of good faith.*

Twenty copies of the number containing his communication will be furnished free to any correspondent on request.

The editor will be glad to publish any queries consonant with the character of the journal.

Experiments in Visinn again.

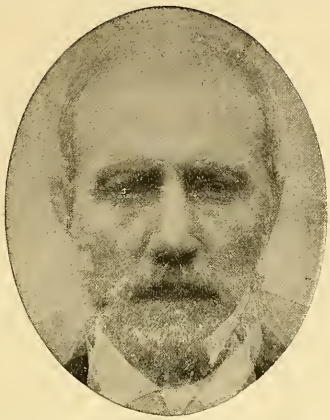
MR. HYSLOP, in his interesting letter on this subject (*Science*, No. 274, p. 217), asks for verification of his results. In my case, when his two circles are combined by convergence, there is not the least alternation of images, but, on the contrary, a complete combination and a single horizontal ellipse, whatever be the degree of inclination of the planes of the circles to one another, provided the inclination to the median plane be the same. But the binocular ellipse will seem inclined to one side or the other if there be the least want of symmetry in the inclination of the two planes. This is obviously the necessary result of the law of corresponding points.

I cannot think, however, that so good an observer and so skilful an experimenter as Mr. Hyslop could mistake this for alternation of the two images. I therefore suppose that his eyes are more independent of one another than mine. JOSEPH LECONTE.

Berkeley, Cal., May 14.

Composite Portraiture of the Insane.

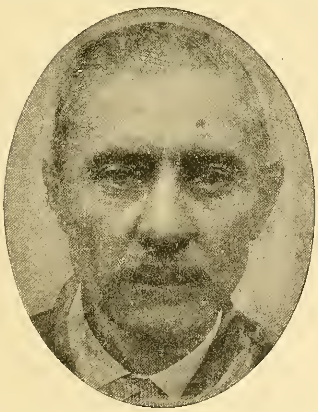
WITHIN the last year considerable advances have been made in composite photography; and especially Professor Stoddard, by his articles in *The Century*, has done much to give us new types. Most studies in composites have been confined, up to this time, to normal individuals, and, so far as the present writer is aware, no attempts have been made to secure composite types of insanity. The accompanying composites were made by the Notman Photographic Company of Boston, from negatives taken by the writer in November, 1887. The composite of general paresis is made from the portraits of eight patients, — three females, and five males. General paresis, being an organic brain-disease (softening of the brain), furnishes an unusually good field for the study of the decay of the mental faculties; and the patients making up this composite were all in the second stage of the disease, when it was beginning to destroy the finer lines of facial expression. A comparison of the composite of paresis with that of melancholia — eight subjects, all men — will show the characteristic differences between the two diseases. The eyes of the composite of paresis have a fixed and staring look, showing clearly a diminution of intelligence, and differing entirely from the expression of the other composite, where the expression is sad and thoughtful, but by no means lacking in intelligence. Of the patients suffering from paresis, one of the women and three of the men had had apoplectiform seizures ; and the average duration of the disease at the time of photographing, was, in the women, two and one-third years, and in the men one and three-fourths years. The average duration of paresis, before it terminates fatally, is usually stated to be between three and four years. Of the patients making up the composite of paresis, all, with the exception of one woman, were in good general physical



COMPOSITE OF EIGHT PATIENTS SUFFERING FROM MELANCHOLIA

condition, and able to go out walking, and join in the usual round of asylum-life : and this one woman was still able to go out walking on pleasant days, but was not so vigorous as the others.

The composites seem fairly to represent the physiognomy of the two diseases ; and that of paresis has been spoken of by several alienists as being a typically characteristic face. The well-known look of easy-going complacency of paresis is strongly shown in the portrait.



COMPOSITE OF EIGHT PATIENTS SUFFERING FROM PARESIS.

Mental diseases offer an excellent field for the study of types, and it is to be hoped that further work in this line may give a more just conception of the typical expression in the different forms of mental disease than has hitherto been obtained from portraits of individual cases. The portraits were first published in the *Journal of Nervous and Mental Disease*, and are reproduced here in the hope that they will prove of interest to others than the medical profession. WILLIAM NOYES, M.D.

New York, April 13.

The Significance of 'Variety' and 'Species.'

THERE is no question in biology more significant, or more difficult to answer, than what constitutes a species. Upon the answer hinges the question of evolution, and more particularly the theories of Darwin. In spite of an immense amount of discussion, no answer has ever been given to the question which is in any degree satisfactory. Certain it is that no definite amount of difference can be regarded as enough or as too much to constitute a difference between two species. The term 'species' is compatible with a great amount of unlikeness on the part of varieties, or equally compatible with extremely small differences between species. Our pigeons form an example of the first class ; and many species of insects, of the second. In the former we find within the limits of a single species an immense variety, the differences between the varieties sometimes surpassing that between different families in a state of nature. In the latter we have many species so closely like each other as to require an expert to see any differences at all. It is plain to every student that the term 'species' is a variable one, and its limits cannot be found in any definite amount of anatomical variation. And yet, after all has been said concerning the indefiniteness of the term, every one will recognize that the word 'species' does mean something, and expresses some fact in nature ; that even though, according to Darwinism, a species is merely an exaggerated variety, yet there is a difference between a species with many varieties and a genus with many species. The latter indicates, as every naturalist feels, a more fundamental difference of some sort, even though to all appearances the differences may be less. Darwin did not regard the various pigeons as forming different species, in spite of their unlikeness.

This is not the place for a discussion of this matter, which would involve the whole work of Darwin and his followers. There is one suggestion, however, brought first prominently into notice by Romanes (*Nature*, August, 1886), which has not received the attention it deserves, at least in this country. The suggestion is briefly this : that differences between species are due to the accumulation of differences in the sexual organs, entirely independent of anatomical differences. This idea does not belong exclusively to Romanes, for it was independently suggested by at least three others prior to the publication of the paper of Romanes (CATCHPOLE, *Nature*, xxxi. p. 4 ; BELT, *Naturalist in Nicaragua* ; and myself, *Evolution of To-day*, p. 41). Romanes alone, however, expanded the view, and took upon himself to defend it against the criticisms which were abundantly offered. In so doing he referred to the principle of natural selection in such a way as to rouse the enmity of many who revered Darwin's name and work, by claiming that Darwin did not explain the origin of species at all, but only the origin of adaptation. In thus seemingly attempting to belittle Darwin's discovery and relegate it to a very subordinate position, Romanes called upon himself a severe criticism from many who refused to see in his 'Physiological Selection' any thing new or important. These criticisms, though certainly showing that Romanes had overrated the value of his principle in removing the difficulties in the way of the production of new species, did not by any means show that this principle was not an important factor. The idea is certainly new to literature ; and, although it may have been hinted at by others, no one before Romanes formulated it so as to draw a clear distinction between anatomical and sexual variations. Whether or not the idea be regarded simply as a particular application of the principle of natural selection, as some of the critics claim, is entirely immaterial to the value of the conception. There is nothing in Darwin's writings to indicate that he had entertained the thought that species are due to the selection of sexual variations, while varieties are due to the selection of differences not necessarily sexual. This idea, whether we regard it as an instance of natural selection or not, certainly deserves careful study as promising to help in the solution of the puzzling problem of species.

There is no fact which has given rise to more discussion, or has seemed to offer such difficulties in the way of Darwin, as the alleged sterility of species when crossed. Many were the experiments, and vast the amount of evidence collected, by Darwin for the purpose of showing that the sterility of hybrids is not a law ; and he did conclusively show that there is no absolute bar thus separating species, for many cases were found where species were fertile when crossed. The broad fact remains, however, that, in spite of many exceptions, the rule is that different species, when crossed, do not produce fertile offspring; and I do not think this conclusion is doubted by any one. Though the difficulty is lessened by the experiments on cross-breeding, it is not removed; but the difficulty does not lie exactly where it is usually put. The difficulty is not that species are sterile when crossed, but that varieties, however diverse they may be, are always fertile. It is not difficult to understand why the descendants from a common form, should, by the principle of divergence of character, become so unlike each other as to be incompatible with each other when crossed. The difficulty lies rather in the fact that in all the experiments of breeders there has been no approach toward the production of sterility between the varieties produced. Breeders have succeeded in profoundly modifying animals, and in producing a great number of diverse varieties. Sometimes these varieties show greater differences than are shown by separate genera or families of wild animals. And yet there is no tendency observable toward the production of sterility among these varieties, perfect fertility being the universal rule. To explain why a large amount of structural difference in domestic varieties should be accompanied by complete fertility, while in a state of nature very slight differences should be attended by sterility, in many cases at least, is to my mind the only difficulty arising in connection with the sterility of hybrids.

As an explanation of these facts, it has been pointed out that domestication has a direct effect upon the reproductive powers of animals, sometimes producing sterility, and sometimes increased fertility. This factor has been suggested, therefore, as explaining why the varieties of domestic animals have not become infertile. But the differences to be explained are very great. Most excellently was this matter illustrated by Professor Clark at the last meeting of the American Society of Naturalists. For illustration he used a large number of mounted specimens of pigeons obtained from different fanciers, and a series of mounted sparrows which may be found everywhere. Among the pigeons the greatest profusion of color, size, shape, length of bill, etc., was observable, all within the limits of the same species; while among the sparrows a sharp eye was required to see any differences between species, and sometimes between genera. Allowing what we will for the effect of domestication, it is a remarkable thing that the fantail and powter will breed together perfectly well, so that care must be taken by the breeder to keep them separate; while the different species of sparrows with such close resemblance do remain perfectly distinct. Of course, also, the existence of varieties in nature cannot be due to domestication. All of these facts seem to indicate that some different process has been at work in the production of species from that which has given rise to these very diverse varieties.

Now, all of this class of facts receives a ready and natural explanation in the hypothesis suggested above. All domestic varieties have been artificially preserved by man, and he has naturally selected for preservation such peculiarities as are particularly pleasing or useful to him. It is plain enough that he has not included in his selection peculiarities of the sexual organs: for these are frequently not visible, and have never been the object of improvement on the part of the breeder. Plumage color, shape, size, strength, swiftness, etc., have all received attention; but I have yet to hear of a single instance where sexual variations have been selected. Certainly this has not been done in the pigeons, or dogs, or other animals, where such great diversity has been found compatible with perfect fertility. There can be no doubt that the sexual nature is just as truly subject to variation as any other part of the body. Every one knows of variations in fertility, in size and shape of sexual organs, in sexual passions, all of which plainly indicate, that, though not so evident to observation, variations in the sexual system are as abundant as elsewhere. Further, it is evident that sterility of species when crossed must be due to some differences in the sexual organs or sexual elements which prevents proper fertilization or proper growth after fertilization. Is it not, then, a natural conclusion that an accumulation of sexual variations will result in sterility, while any accumulation of other variations will not necessarily have the same effect unless they are also accompanied by sexual variations? Under artificial breeding there have been produced anatomical varieties based upon structures which have had no necessary connection with the sexual nature, and hence the varieties have not become sterile. On the contrary, the uniform conditions of experiment, the rejection by the breeder of individuals which have shown abnormal sexual instincts, have tended to prevent the development of any sexual differences sufficient to produce sterility.

Under nature, however, the conditions have been very different. There has been no rigid conforming of selections to anatomical differences. Hardships, famines, surplus of food, etc., have all had their effect; and there is no part of the body so soon affected by such changes as the reproductive system. Animals have had every opportunity for the free exercise of every passion, and thus differences in the reproductive system have come in for their share in accumulation by natural selection, or otherwise. Romanes is indeed inclined to think that such variations will be specially favorable for preservation, since they will tend to prevent crossing of unlike individuals. This is, however, doubtful; but it is plain enough that they will have a much more favorable chance for preservation than they do have under domestication. By variation in this direction there may thus be produced species which will be sterile when crossed, and yet with very small anatomical differences. On the other hand, there may be varieties which would differ widely in anatomical characteristics, and yet be perfectly fertile when crossed. The difference between a highly variable species and constant species would be thus due to the readiness with which variations in the reproductive system are produced and preserved. Where the reproductive system is constant, there may arise a highly variable species; but where the reproductive system is highly variable, there will be a tendency to the production of numerous closely allied species. All of this will lead to a new understanding of the significance of species as groups of animals in which variations have largely affected the sexual organs, with sometimes great and sometimes little change in other parts of the body. In varieties, on the other hand, variation may have affected any other part of the body to almost any degree, but has not affected the sexual system. This understanding is somewhat different from that of Darwin, since it does not regard a species simply as an exaggerated variety. Sometimes it may be so, since anatomical and sexual variations may accompany each other. Sometimes, however, a species may be produced directly by sexual variation, without passing through any prominent stage, in which it is a simple variety. Variety and species are therefore independent, being founded on different kinds of variation.

A discussion of this hypothesis is not possible here, the design of this note being simply to call the attention of American naturalists anew to the subject, and to state the hypothesis as it lies in the mind of the writer. It would be a very important series of experiments if some one who has opportunities for experimental breeding would undertake the production of a distinct species by selecting sexual rather than anatomical variations. Such a series of experiments might solve the question of the origin of *species*.

H. W. CONN.

Middletown, Conn., May 15.

The Ohio Mounds.

THE evidence brought to light by the explorations of the Bureau of Ethnology bearing upon the authorship of the typical ancient works of Ohio, leaves scarcely a doubt that these structures are to be attributed to the Cherokees. The chain connecting the Cherokees of modern times with the builders of these celebrated works seems to be so complete as to leave no break in which to thrust a doubt.

These explorations have also thrown some light on the so-called clay 'altars' of the Ohio mounds, rendering it probable that they were places for torturing prisoners of war, — the chief 'sacrifices' the Indians were in the habit of making. Strange as it may seem, the chain of evidence on this point reaches into actual history.

The ancient works of Ohio are attributable to at least four, but probably more tribes. CYRUS THOMAS.

Youngsville, Penn., May 14.

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Map of the Yellowstone Park.

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SCIENCE

FRIDAY, JUNE 1, 1888.

Last week we called attention in a few words to the struggle which is going on in the New York City Board of Education over the election of a superintendent of schools. It is a cause of gratification to observe that the question has been lifted above and beyond mere petty detail, and made to rest on broad educational principles. Commissioner Sprague, who has conducted the inquiry into the fitness of the present incumbent for re-election, has shown great ability and a thorough grasp of the real issue. In his examination of Mr. Jasper he brought out the fact that the latter did not attend educational meetings, did not write or speak on education, and for four years had made no attempt to visit and inspect the schools systematically. On being pressed for an explanation, Mr. Jasper said that he had no time for any of these things! In other words, he is so busy marking examination-papers, computing percentages, and doing other trivial clerical work, that he could not be in any sense of the word a superintendent of schools. This admission should be a source of shame, both to the Board of Education that permitted such a state of affairs, and to the superintendent who did not protest against it. It proves exactly what has been charged; namely, that neither the majority of the Board of Education nor the city superintendent are fit for the positions they hold. In a series of interviews with four or five of the most prominent and respected educators in New York City, which a daily paper has published, substantially the same criticism that we made in these columns last week occurs. One said, "Our system does not properly educate, and is conducted too much on the principle that the teacher's work is to cram the pupil with hard facts." Another added, "The theories of the Board of Education are on trial. . . . The school system in this city is nothing more nor less than a magnificent piece of machinery, crushing out, whether designedly or not, all individuality, and tending to repress all the natural activities of the pupil. Uniformity is the thing aimed at, and the uniformity achieved is that of mediocrity." These expressions come from men who have made education a lifelong study, and who know what they are talking about. The force of such damaging testimony cannot be easily broken.

The resignation of Professor Lovering of the chair at Harvard which he has held for fifty years calls for more than passing mention. Professor Lovering first entered the service of the college as a tutor in 1836, and in 1838 was elected Hollis professor of mathematics and natural philosophy. During this period much of the development of physical science has taken place, Professor Lovering's contributions winning for him first the presidency of the American Association, and later that of the American Academy, over which latter society he still presides, following in the line of the very distinguished men who have held the office. In accepting the resignation, which takes effect next fall, the president and fellows expressed their belief that "as a teacher, an administrative officer, and a member of the faculty, Professor Lovering has served Harvard College with perfect fidelity and loyalty, and with sound discretion. As a public lecturer and man of science, he has done honor to the university, and to the department of instruction which he represented." They also felicitate Professor Lovering and themselves upon the condition of assured prosperity in which he leaves the department of physics, — the department to which he has devoted a long and well-filled life. The successor of Professor Lovering is Prof. B. O. Peirce, who has given much promise in mathematical physics.

THE YELLOWSTONE NATIONAL PARK.

The present number of *Science* is accompanied by a map of the Yellowstone National Park, reduced from the surveys of the United States Geological Survey. The four-sheet map of the latter, which is based on explorations during the years 1884 and 1885, gives for the first time accurate information regarding the configuration of mountains and valleys. We do not deem it necessary to dwell upon the wonders of the park, which have for years and years proved so attractive to Americans as well as to foreigners, but it may be of interest to learn what measures have been taken of late to improve it and to preserve its natural beauties.

As in 1886 Congress failed to make any provision for the pay of the superintendent of the park, a detail of cavalry was sent to do duty in the park. One of the principal dangers the protectors of the park have to contend with are forest-fires, many of which originate through the carelessness of camping-parties. In August, 1886, many square miles of woods near Gardiner River were thus destroyed before it was possible to check the progress of the fire. Some of these forest-fires are attributed to unscrupulous hunters, who, being prevented from hunting in the park, resort to this method of driving the game beyond the park limits. It is stated that the park is surrounded by a class of old frontiersmen, hunters and trappers, who, as the game diminishes outside the park, increase their efforts, and resort to all sorts of expedients to get possession of that which receives the protection of law. Some fires seem also to have been started by Bannock Indians from the Lemhi Reservation.

Another source of danger to the beauties of the park lies in the vandalism of the visitors, which cannot be condemned too severely. The acting superintendent, Capt. Moses Harris, says in his report to the secretary of the interior, 1886, regarding this subject: —

"It is apparent from the most casual observation that the means heretofore employed for the preservation of the natural objects of wonder and beauty in the park have been entirely inadequate. It may be said without exaggeration that not one of the notable geyser formations in the park has escaped mutilation or defacement in some form. Those that have been most fortunate are covered with lead-pencil inscriptions recording the names of those shallow-minded visitors to whom such a distinction is a pleasure. A lead-pencil mark seems to be a very harmless defacement, but names bearing date of 1880 are still discoverable through the thin deposit of silica; and, if this marking should go on unchecked, in a very few years these once beautiful formations will have become unsightly and unattractive objects. At the Upper Geyser Basin names with date of June, 1886, have been chiselled into the solid geyserite so deep, that, in the slow process of nature, many years must elapse before this mutilation will be obliterated. Not content with the defacement of the formations, efforts are constantly being made to destroy the geysers themselves by throwing into them sticks, logs of wood, and all sorts of obstructions. The eruptive force of several of the geysers has been totally destroyed by vandalism of this character. The footsteps of the throngs of visitors are wearing away the delicate and lace-like tracery of the silicious deposits, and in a few years the formations surrounding the geysers will present the appearance of the worn pavements of a city street. The wilful defacement of these beautiful objects can only be prevented by watchful supervision, supported by the rigid enforcement of lawful penalties. A certain amount of wear and deterioration, incident to the multitude of visitors, is probably unavoidable."

In the annual report for 1887 the superintendent gives an interesting statement regarding the game living in the limits of the park: —

"Immense herds of elk have passed the winter along the travelled road from Gardiner to Cook City with the same safety which herds of domestic range cattle enjoy in other localities. Several stacks of hay, which had been placed along this road in anticipation of winter freighting, were appropriated and doubtless enjoyed by these animals. It is difficult to form any accurate estimate concerning the number of elk that passed the winter in the park: certain it is that the number that wintered in the valley of Lamar River and on its tributaries have been estimated by all who saw them at several thousands. The elk are accustomed, when driven out of the mountains by the snows of winter, to follow down the course of the mountain-streams into the lower valleys. For this reason but little efficient protection can be afforded to this species of large game in the park except upon the Yellowstone River and its tributaries.

"The elk which follow down the outward slopes of the mountains surrounding the park, along the tributaries of the Madison and the Gallatin on the west, or the Snake River on the south, pass beyond the park limits before the hunting-season permitted by the territorial laws has closed, and fall an easy prey to the hunters who are in wait for them.

"A small number of buffalo still remain in the park, but, after as careful and thorough an investigation as is practicable, I am unable to state their numbers with any approach to accuracy. My impression is, that they have been heretofore somewhat overestimated, and that at the present time they will not exceed one hundred in number. They are divided into three separate herds. One of these ranges between Hell-roaring and Slough Creeks in summer, well up on these streams in the mountains, outside the park limits; and in the winter lower down, on small tributaries of the Yellowstone, within the park. If the reports made several years ago can be relied on, this herd has rapidly diminished, and it is doubtful if it now exceeds some twenty or thirty in number. Whether or not this decrease has been due to illegal killing by hunters, or to other causes, I am unable to say, though I do not believe that many have been killed within the past two years. Another herd ranges on Specimen Mountain and the waters of Pelican Creek. The herd was seen by reliable parties several times last winter, and was variously estimated at from forty to eighty. A traveller on the Cook City road claimed to have counted fifty-four near the base of Specimen Ridge. A scouting-party which I sent out during the month of May found but twenty-seven head of this herd, with four young calves. It is possible that the herd at this time was broken up, and that but one portion of it was found. The third herd ranges along the continental divide, and is much scattered. A band of nine or ten from this herd was seen several times this spring in the vicinity of the Upper Geyser Basin. It will take close observation for several years to determine with any certainty the number of these animals, or whether or not they are diminishing in numbers. It is practically certain that none have been killed within the park limits during the past two years, and yet there is an equal certainty that the present numbers do not approach those of past estimates.

"Large numbers of antelope are found in the park. A herd of some two hundred passed the winter within a mile of the town of Gardiner, pasturing on the plain between the Yellowstone and Gardiner Rivers, south of the town. They were unmolested, though it was found necessary to occasionally drive them back towards the hills, that they might not get beyond the park limits.

"The mountain sheep are found in all of the mountain ranges within the park. A band of seven or eight spent a large portion of the winter in the cliffs along the travelled road between Mammoth Hot Springs and Gardiner, and they became so accustomed to the sight of travellers as to manifest but little more timidity or wildness than sheep of the domestic variety."

The progress of road-construction in the park has been greatly retarded by the lack of sufficient appropriations. It is greatly to be regretted that the beauties of the park, that, in the words of the statute, has been "set apart as a public park or pleasuring-ground for the benefit of the people," is not rendered accessible in all its parts to the public by the construction of roads and bridges, the cost of which has been estimated at $130,000.

It appears that the only method of enforcing the laws and regulations regarding the park is the expulsion of all offenders, there existing no court which has jurisdiction over such cases. The superintendents of the park have for a number of years asked that such a court be established, but so far Congress has not acted upon their suggestions.

It seems, however, on the whole, that the park is well protected from injury, and the steadily increasing number of visitors shows that it has not decreased in attractiveness either to Americans or to foreigners.

A NEW SCIENCE OF MIND.

The authorities of the Collége de France, the representative institution of the higher education in France, have transformed, as already reported in *Science*, the chair of the 'law of nature and of nations' into a chair of 'experimental and comparative psychology.' The significance of this action lies in its calling the 'new psychology' to a co-ordinate rank with the more widely recognized and historically sanctioned sciences. This honor has naturally caused considerable inquiry as to the nature and the objects of the new science; and M. Paul Janet, the well-known writer on ethical topics, undertakes to enlighten his countrymen in this regard ('Une Chair de Psychologie Experimentale et Comparée au Collége de France,' *Revue de Deux Mondes*, April 1, 1888).

M. Janet, with perhaps pardonable patriotism, poses the new psychology as of French origin, but it is really connected with the past by many roots. It is related to the objective study of mind furthered by Hartley and Locke, by Descartes and Cabanis; its welfare has been more essentially secured by the general renaissance of physiological and neurological studies of which the name of Johannes Müller is representative; the modern alienists drew attention to the valuable mine of mental phenomena that disease laid bare; and, after it emerged as an independent study, it willingly acknowledged its indebtedness to physics and physiology, as well as to psychiatry and anthropology, without forgetting its parentage from the psychology of the past, itself the result of a progressive philosophic insight.

The term 'physiological psychology,' though quite generally in use to describe the new movement, really expresses but one, though perhaps the most important and advanced, division of a scientific, or, as M. Janet prefers, an objective psychology. The new psychology, however, is characterized as much by its method, its spirit, as by its contents; and it was for this reason that the chair was called one of 'comparative' and 'experimental' psychology.

Difficult though it is to summarize the various lines of interest that unite workers in the several specialties of the new psychology, the attempt may be useful. From the physiological side, psychology finds that the phenomena with which it is concerned occur in connection with a material organism of an intricate and mysterious construction. The analogues of the acts which we recognize in ourselves as the indices and concomitants of psychic states are unmistakably found in the lower animals. No matter how far down in the scale we descend, we nowhere lose the thread that makes the world akin. "The tendency of modern inquiry," says Mr. Tylor, "is more and more towards the conclusion, that, if there is law anywhere, it is everywhere;" and in the amœba stretching out its extemporized arm in response to an irritation in its environment, psychology detects a real though remote analogy to that varied and far-sighted adaptation of means to ends that characterizes the life of a high civilization. The problem, then, is to trace the successive stages of this co-ordination of nervous structure with psycho-physiological function; to see reflex act emerging into instinct; to see instinct acquiring more and more adaptability, and sending the young into the world less freighted with the ready-made acquisitions of their ancestors, and freer to shape their lives according to outward conditions, until, in the human infant, nature presents at once the most helpless and the most educable of organisms. This general problem includes many special ones. In ascending the evolutionary scale, the nervous system increases in complexity; the parts become more specialized and more integrated; finer methods of study are needed; and when we ascend to the highest product of evolution, the cortex of the human cerebrum, we are presented with the most interesting as well as with the most baffling aspect of the problem. A combination of methods, applied with patience and ingenuity, has divested the problem of some of its mystery. By co-ordinating the symptoms during life with the lesions revealed in the post-mortem examination; by exposing the brains of the lower animals to definite injuries, and carefully recording the results; by removing certain sense-organs or other parts in developing animals, and observing the defects of organization in the adult; by utilizing the exceptions that nature presents, — we have acquired a knowledge of the laws of the nervous system that would have seemed Utopian to our fathers, and that has already enabled the surgeon to predict the location of and remove a tumor in the brain.

The study of the senses has acquired a deeper and a richer meaning since the recognition of its place in a forming science has come about. The revolutionary discoveries of Helmholtz, whose success is so largely due to the union of two sciences, have induced others to continue the work in a hundred directions; and as indicative of the promise that these researches hold out, may be cited the conviction of an eminent physicist, Professor Mach, that the next great movement in the progress of science must come from the union of psychological points of view with physical methods and results. A mere mention of the many investigations that owe their origin to the work of Fechner and the formulation of his psycho-physic law must suffice to indicate the great activity in this field, and to justify the title of an experimental psychology. Moreover, the measurements of the time taken up by various psychic processes, the experimental study of memory, of attention, of the association of ideas, of the bilateral functions, of rhythm and the time-sense, of space and time perceptions, and so on, have led to the development of a mass of ingenious apparatus, and have made the psychological laboratory an indispensable requisite for its satisfactory instruction.

Morbid psychology is a rubric of paramount importance to the full and clear comprehension of the phenomena of mind. The genesis of illusions and hallucinations, the perversion of the natural channels of the emotions, the disintegration of the elements of personality, the dissolution of the logical powers, — all these problems transform the apparently wild and chaotic picture of the madhouse into a sad but interesting record of the process of character and of mind building. This interest is heightened by remembering that here lies the key to the understanding of the psychic epidemics that in the past have upset the rationality of mankind, and transformed the incoherent babbling of some demented soul into the mysterious utterances of a revealed spirit. It is furthermore heightened by the notice that the phenomena conveniently grouped as 'psychic research' are attracting, and always will attract. Hypnotism, after an adventurous and uncertain existence in the hands of charlatans, has been admitted into science; and although the literature of the topic, at least in France, is increasing out of all proportion to our insight into the nature of the phenomena, yet enough has been established to recognize in this semi-morbid condition the key to the solution of many otherwise barely accessible problems. With regard to those borderland phenomena, — 'telepathy,' 'clairvoyance,' and the like, — they illustrate the subtleness of the process by which false systems gain success, and demonstrate the advisability of having men who can speak on such topics with the authority of trained experts.

What its votaries have deservedly dignified into the science of 'anthropological psychology' offers a most attractive field for research. The customs and thought-habits of primitive peoples not only record the first stages in the progress that leads to culture, but prevent the formulation of notions that seem true enough when tested by our own civilization, but reveal the provinciality of their origin when applied to more rudimentary conditions of life. Instead of *résumé*-ing the many rubrics that here contribute to the completeness of a scientific psychology, one may refer to the works of Mr. E. B. Tylor as exemplifying at once the attractiveness of the subject, and the value of the results, under a learned and skilful treatment.

If we conclude this survey with the mention of the psychology of the developing child, glimpsing as it does, in the budding capabilities of the infant, the microcosm of the race and an epitome of the struggle for civilization, it is not because the lines of research have been exhausted, but that, with the scope of the science thus outlined, what remains to be done will probably be suggested by what has been said. The psychology of the infant is not the only point at which psychology and education touch; but everywhere education must refer to psychology, of which, in the highest sense, it is only the practical application.

The movement has not been without its opponents. The cry has been raised that it is not a science, but a mere aggregation of disjointed facts: it shines by borrowed wealth. But the force of this objection is weakened, if we remember that a science maintains its individuality quite as much by the point of view from which it regards its subject-matter as from the nature of the subject-matter itself. It is not an evidence of weakness for one science to borrow from and build upon another; but it testifies to the unity of the phenomena of nature, and reduces the division of the sciences to what they at bottom represent, — the classification of the direction of men's interests. The chaotic condition of the facts with which psychology deals is rapidly disappearing, and it may yet hope to receive a unifying impulse such as Darwinism gave to zoölogy. It is, at all events, better to have a collection to arrange when the true method of arrangement shall be discovered, than not to collect because the ideal arrangement is not yet at our service.

Again: there are some, who, heedless of the caution of George Henry Lewes, — that the first question is not, "What does it lead to?" but, "Is it true?" — see in the objective study of mind the downfall of idealism, and of all the valuable beliefs that have clustered about it. They stigmatize it as materialistic. This is surely a misunderstanding. The history of the movement does not bear out such an accusation. The men the spirit of whose work is in line with a scientific psychology — Lotze, Helmholtz, Fechner, Wundt — are all of them the very opposite of materialists. The new movement does not attempt to usurp the place held by other studies, except as it is an advance upon them: it does not pose as the only department of philosophic learning. Its professors have fortunately been men of liberal sympathies, and deeply imbued with the historical sense. They do not claim to have created a science entirely new, unique, and undreamt of, but appreciate their development from the past. Their aim is to retain for the study of mental science that high place which has always been accorded it, by making it progressive and abreast of modern learning.

Professor Ribot, in the opening lecture of his course at the Collége de France (*Revue Scientifique*, April 14), taking a bird's-eye view of psychological activity in the various countries of civilization, saw everywhere signs of great promise. The literature is increasing both in value and in quantity. The science has reached the 'monograph' stage. Journals specially devoted to its interests, such as the *Philosophische Studien*, the *Revue Philosophique*, the *Rivista di Filosofia Scientifica*, and our own *American Journal of Psychology*, are flourishing; and laboratories and professorships for the dissemination of its teaching are being established at the leading universities. With the advantages that the youth and plasticity of our educational institutions give them, and the successful examples of the leading universities before them; with the practical ends that the new movement embraces; and with our pushing enthusiasm to have every thing that is new and good, — it seems justifiable to predict for scientific psychology a large and representative following in this country. JOSEPH JASTROW.

ABORIGINAL ARCHITECTURE IN THE SOUTH-WEST.

A FIELD-PARTY of the Bureau of Ethnology, in charge of Mr. Victor Mindeleff, has recently returned to Washington, bringing a large amount of new and valuable material. For a number of years past Mr. Mindeleff's investigations have been confined to the architecture of the South-west. One of the most interesting places visited by him during the past season was a group of cave-dwellings situated about eight miles north-east of Flagstaff, Arizona. These ruins had previously been visited by Major Powell and Mr. Stevenson.

The remains occupy the summit of a cinder cone, and extend some distance down the south side. The rooms are numerous, and are excavated in the top and sides of the cone, forming rough, dome-shaped cavities, with an opening for ingress in the rounded or flat top of the dome. These cavities are densely grouped on the summit of the cone, and more scattered lower down. Halfway from the summit to the lowest level of occupation were found traces of a continuous rampart wall.

Large lumps of the porous substance composing the hill had been removed to form the chambers, and piled up outside, forming rude walls enclosing the openings. Some of the chambers are quite small, and were probably used for storage, as the only means of access to them is through the larger rooms. The floor-levels vary considerably: many of the storage-rooms are several feet higher or lower than the connecting large room. This difference in floor-level is in some cases the result of an effort to conform to the topography of the site.

The entrances are usually much broken away, but were probably rectangular. In several cases a rectangular niche or channel, forming part of the entrance-opening, was seen, occurring sometimes in the centre, sometimes at one end of the side of the same. These channels may have served as chimneys, as there is considerable evidence of smoke-blackening in the recesses, as well as on the roof of the cavities. An abundance of fragments of metates was found, of the massive type which occurs in the vicinity of Globe, and also some complete ones. Upon the upper part of the cone a considerable number of potsherds were seen, all the fragments quite small.

Some cliff-dwellings in Walnut Cañon, about twelve miles southeast of Flagstaff, Arizona, were examined. The ruins are quite small, rudely and carelessly built, and suggest occupation by a small community and for a short time. They are distributed over several ledges of the cañon at varying heights from the stream-bed below. At the time of the visit the bed of the stream was dry. Above, adjoining the cañon brink on the north, occur several clusters of rooms which probably had some connection with the cliff-dwellings. Two piles of stones — the remains of rude walls — were seen at a distance of three or four miles from the cliff-dwellings. They seem to be the remains of single rooms. Similar vestiges were found at points north of the vicinity of the cave-lodges above described.

In the vicinity of Keams Cañon, Arizona, an extensive group of ruins was examined, occurring along the north border of the Jeditoh valley, on an escarpment overlooking that valley. There are seven ruins in the group, so far as known, distributed over an extent of twelve miles. The westernmost and largest ruin is known as Awatobi, or under its Navajo name of 'Talla Hogan.' It has been often visited by parties of the Bureau of Ethnology and by others, and has been identified as the Aguatobi of Espejo's narrative (A.D. 1583). It was occupied only a short time after Espejo's visit. The whole group of ruins is directly connected by tradition with the present inhabited villages of Tusayan (Moki), having been built and occupied by gentes whose descendants constitute a portion of the present Shimimo Indians. Awatobi is an extensive ruin, and others of the group are but little inferior in size, though in the latter, as a rule, no standing wall remains. The direction and distribution of the walls can, however, be easily traced. All the ruins of this group occur on the immediate edge of the escarpment, and overlook wide areas of valley-bottom, including fine stretches of cultivable land.

The party afterwards camped for some time in the vicinity of Oraibi, the westernmost and largest of the present villages of Tusayan. The work here was a continuation of the work of a party which visited Oraibi in 1882, when the village was surveyed. A study was made of the constructional devices in use at Oraibi and some of the other villages, and many photographs of interesting features were made. The methods in use here are more primitive than in ony other pueblo. They show also less white or Mexican influence, and consequently are valuable as throwing light on primitive architecture.

Two interesting ruins were discovered and surveyed. They were both found upon the west side of the 'Oraibi Wash,' a large valley running north and a little east from Oraibi, from which the ruins are distant seven and fourteen miles respectively. They both occur upon the summits of small buttes detached from, but close to, the edge of the mesa forming the west side of the valley, and are so situated as to command an extensive view of the valley proper and of one or more of its smaller branches. The buttes are quite similar in character. The summit, in both cases, is of small area, formed of bare rock, almost flat, and breaking off almost continuously around its edge into a ledge eight or ten feet high. The ruins occupy the whole of the summit, and extend down over the slopes, which fall away from the base of the ledge. The ruins themselves are similar in character, and both are directly connected traditionally with Oraibi. The Navajos also have legends concerning them.

In the northern ruin was found an interesting cave, or underground apartment, occurring within the ruin. The entrance was very small, and had been, until recently, carefully concealed. It is said to have been broken open by Navajos in search of ancient pottery. Inside were found some well-built stone walls with supporting timbers, but the cave was too much filled up with dust and *débris* to permit much exploration without excavation, for which both time and means were lacking. A visit was paid to the small village of Moen-Kopi, which is inhabited during the farming season only, and occupies the same relation to Oraibi that Ojo Caliente, Nutria, and Pescado bear to Zuñi, — a sort of outlying settlement or farming pueblo. It is situated on the north side of the Moen-Kopi Wash, which for some distance above and below this point presents an almost vertical wall. Here, however, the cañon wall breaks down into a gentle slope, and a small valley puts out to the north. It is at the junction of this valley with the main cañon that the village is located, about halfway up the slope. In the smaller valley are a number of fine springs, situated some distance above the cañon bottom. These springs probably determined the location of the settlement. The whole of the valley was under cultivation, being irrigated from these springs, as was also a considerable portion of the bottom of the cañon proper, overlooked by the village. Farther down were large fields of corn and wheat. One of the most interesting things to be seen in this vicinity is the cotton-fields. Cotton was grown by these Indians prior to their discovery by the Spaniards, and occupies a very important place in their mythology. It is a sacred plant, and garments or articles of apparel made from it are used only in the sacred ceremonials. At the present time Moen-Kopi is the only place where cotton is grown, but tradition mentions several other localities. Seeds of North Carolina cotton and Maryland watermelons, sent out in 1885, were found to have deteriorated but slightly, though they had passed through two plantings. The cotton is not allowed to ripen on the stalk; but the pods are broken off while yet green, and laid in the sun, upon the roofs of the houses, until they burst open. This village is but fifteen or twenty years old, but has been built on the site of an older settlement.

Subsequently the party spent six weeks at the Chaco ruin. These ruins have been frequently described, and ground plans of some of the larger ones have been published. An accurate survey of the more important ruins was made, and the plans secured reveal many important points. The drawings and descriptions of Simpson and Jackson, made in 1849 and 1877, are of so general a nature as to be misleading. No such symmetry, for example, as that portrayed in their plans, is to be found: in this respect the Chaco ruins are not superior to hundreds of others. The quality of the masonry has also been much exaggerated, though doubtless unintentionally. A close examination revealed great ignorance, on the part of the builders, of some of the simplest principles of construction. Another feature of interest was the very plain evidence of successive or different occupation. In Pueblo Bonito, the largest ruin of the group, three distinct types of construction were found, lapping over and extending into each other. Several ruins not previously known were surveyed, and others were visited. Mr. Morgan attempted to identify the Chaco ruins with the celebrated 'Seven Cities of Cibola;' but the number is nearly seventy, instead of seven. Upon the exposed or south side of the cañon bottom are a great number of ruins which so far have been overlooked, though they are not inferior in extent to the well-preserved specimens under the north cliff; they are, however, almost completely obliterated through the action of the elements. There is no reason to suppose, however, that the ruins on the south side of the cañon bottom are more ancient than those upon the northern side: their exposed position has simply hastened their destruction.

Late in the season some of the party visited and made a survey of the Pueblo of Jemez, situated upon a creek of the same name, a small tributary of the Rio Grande. An accurate ground plan was made, corresponding in every respect to the plans made in previous years of the pueblos of the Little Colorado.

At various times during the progress of the field-work, opportunities were afforded of making studies of Navajo architecture. These Indians build a house of a rudely conical form, composed of brush and earth upon a supporting framework of timber; and their 'hogans' are of considerable interest, and throw much light on primitive house-construction. While the party was at Keam's Cañon a large number of these houses were examined, under the guidance and with the help of some of the best men in the tribe. No less than five distinct types of structures were found, although the details of construction are minutely prescribed and rigidly adhered to. The 'hogans' always front the east; and the erection of one is an important and a sacred event to those interested, being accompanied by many ceremonial observances and an elaborate ritual.

The material collected during the field-season will be incorporated into reports now being prepared by the Bureau of Ethnology.

EXPLORATIONS IN GREENLAND.

IN the year 1886 the Danish Government sent out an expedition for the exploration of the region of Upernivik and Tassiussak, which had hitherto been almost unknown. Lieutenants Ryder and Bloch wintered in Upernivik, and intended to set out early in spring on an expedition northward. Unfortunately the winter proved to be very severe, and the dreaded dog's disease swept away the dogs of the natives, compelling the explorers to start as soon as the increasing daylight permitted, as the dogs were wanted for sealing in April and May. On Feb. 21, 1887, they left Upernivik, and on the following day arrived at Tassiussak, the most northern trading-station. Here they procured a few dogs, and continued their northward journey, the thermometer ranging constantly under the freezing-point of mercury. As the Greenlanders did not build snow-houses, travelling was very difficult, and the explorers as well as their Eskimo companions suffered severely from frost-bites. The difficulties were increased by deep snow; and as no ice-bears were met with, on which the travellers had to rely for dog's food, they were compelled very soon to turn back. The failure of this expedition to reach the northern parts of Melville Bay is to be greatly regretted; but its results show that an exploration of the coast by means of dog-sledge, and early in spring, is not at all difficult.

The travellers reached Upernivik in March, and in April explored the large fiord east of the colony. Here the velocity of the glacier which empties itself into the sea was measured, and found to be thirty-three feet, while in August it amounted to ninety-nine feet in twenty-four hours. This result is very remarkable, as measurements of the southern glaciers show a comparatively uniform velocity throughout the year.

On May 7 the first sign of open water was seen on the western horizon; on May 23 the first whaler made his appearance on the outside islands; but the harbor of Upernivik was not open until June 11. This was considered a late date for the breaking-up of the land-ice on the Greenland coast; while in Melville Bay it lasted well into July or August, and on the west coast of Baffin Bay even until late in August. On June 26 Lieutenants Bloch and Ryder made another start northward with two boats. Their progress was greatly retarded by the prevailing fogs, while drifting icebergs made travelling dangerous. On Aug. 4 they reached their extreme northern point in 74° 25′ north latitude. The sea farther to the northward was covered with ice; and as the homebound vessel, which the travellers were instructed to take at Upernivik, left on Aug. 15, they were obliged to return.

Among the results of this journey one is of great interest, — the fact that even the extreme northern point reached by the expedition is inhabited by Eskimo, who visit it every spring. The most northern native village is Itivliarsuk in 73° 30′ north latitude; but

farther north numerous ruins of villages were found, and the Eskimo had names for every point and island. Thus it appears that the distance between the North Greenlanders and the inhabitants of Smith Sound is not so great as was generally assumed, and it becomes very probable that intercourse between these tribes in a limited degree existed not very long ago, or maybe still exists.

SCIENTIFIC NEWS IN WASHINGTON.

Collectors and Collections of Jewels and Precious Stones: an Interesting Chapter by George F. Kunz. — A Steel 'Vacuum' Balloon: the Absurd Proposition of a Scientific Crank indorsed by a Committee of Congress. — Death of Prof. E. B. Elliott: a Great Loss to Science. The Tape-Worm in Sheep.

Collections of Jewels and Precious Stones.

THE following is an extract from a paper lately prepared by Mr. George F. Kunz of Tiffany & Co., New York, which will be used as the basis of a report on precious stones, which will appear in the volume on 'Mineral Resources of the United States,' to be issued by the United States Geological Survey a few months hence: —

"A regrettable dispersion of jewels and precious stones took place on May 12 and 14, 1886, when the famous collection formed by the late Henry Philip Hope, and exhibited at the South Kensington Museum for many years, was sold at auction. The Hope collection included the *saphire merveilleux* of Madame de Genlis's 'Tales of the Castle;' the King of Candy's cat's-eye, the largest known, having a diameter of an inch and a half; the Mexican sun-opal, carved with the head of the Mexican sun-god, and historically known since the sixteenth century; an enormous pearl, the largest known, weighing three ounces, and two inches in length; the aquamarine sword-hilt made for Murat, King of Naples; and also many curious diamonds, sapphires, emeralds, and several hundred unique and magnificent gems. Such a collection should be preserved intact as a national possession.

"In 1886 it was decided by the French Assembly that the crown jewels, with the exception of the famous 'Regent' diamond, two of the mazarines, and a few historic pieces reserved for the national museums, should be sold at public auction. These exceptions were made because it was feared that they would fall into the hands of Americans. The sale of this great historic collection took place in May, 1887. The 48 parcels were subdivided into 146 lots; and there were 68 buyers, 12 of whom bought over 1,000,000 francs' worth each. The largest lot, the great corsage, which sold for 811,000 francs, was purchased by a single American firm, the largest buyer at the sale. The purchases of the firm amounted to 2,249,600 francs, or about 34 per cent of the entire sum realized; while as to quality, the same firm obtained more than two-thirds of the finest gems. Among them were the three mazarines; a pear-shaped rose brilliant, weighing $24\frac{27}{32}$ carats, for 128,000 francs; a pear-shaped white brilliant, weighing $22\frac{1}{4}$ carats, for 81,000 francs; a white brilliant, weighing $28\frac{7}{16}$ carats, for 155,000 francs; and an oval brilliant, weighing $18\frac{1}{32}$ carats, for 71,000 francs; or 435,000 francs for the four. All but one of their purchases were secured by private American customers. The great interest attached to this sale was due not only to the fact that many of the gems were of very fine quality, but also to their historic associations. The history of many of them could be traced back several hundred years. In its way this sale did more than any thing that had before occurred to establish a reputation abroad for American taste, wealth, and enterprise.

"The collection of antique gems, numbering 331 pieces, formed by the Rev. C. W. King of Trinity College, England, the greatest of all writers on engraved gems, was sent to the United States for sale in 1881. This collection represents the keystone and the summing-up of Mr. King's vast knowledge, and none has ever been more thoroughly studied. His numerous writings mark an epoch in the study of this branch of archæology; and only the loss of his sight led him to part with his treasures. The growing interest and taste in archæological matters in the United States induced him to send it here to be sold intact. In October, 1881, through the friendly mediation of Mr. Feuardent, it was purchased, and presented to the Metropolitan Museum of Art, by Mr. John Taylor Johnson, then president of the museum, where it has since reposed.

"Near it will be placed the Somerville collection. Mr. Somerville, a Virginian by birth, and a gentleman of fortune and artistic tastes, while spending the past thirty-two years of his life in Europe, Asia, and Africa, has collected cameos, intaglios, seals, and other historical gems; and, as a result of his liberal expenditure of time and money, he is to-day the owner of one of the most unique and valuable collections of engraved gems in the world, numbering over 1,500 specimens, including Egyptian, Persian, Babylonian, Etruscan, Greek, Roman, Aztec, and Mexican glyptic or jewel-carving art. All of these are represented by specimens of singular excellence, affording us a panoramic view of the achievements of civilized man in this direction. This remarkable collection, now at his home in Philadelphia, has been loaned to the Metropolitan Museum of Art, New York, where it will soon be placed on exhibition, and the public will be afforded every facility to study the beautiful achievements of the glyptic art.

"Of greater antiquity and archæologic value, because representing a period before gems were cut in the form of intaglios, is the collection of the Rev. W. Hayes Ward, consisting of 300 Babylonian, Persian, and other cylinders. Two hundred of these he himself collected in Babylon and its vicinity, and sold to the museum at a nominal figure. Since that time he has collected 100 more cylinders. Many of them date from 2500 B.C. to 300 B.C., and are cut in lapis lazuli, agate, carnelian, hematite, chalcedony, jasper, sard, etc.

"The death of Dr. Isaac Lea of Philadelphia, which occurred Dec. 19, 1886, in his ninety-fifth year, robbed the world of a great investigator in the field of precious stones. During the last twenty years of his exceptionally long and useful life, he devoted almost his entire time to studying the microscopic inclusions in gems and minerals; and the cabinet he left contains thousands of specimens of rubies, sapphires, chrysoberyls, tourmalines, garnets, quartz, etc., all of which he had subjected to the most rigid microscopic scrutiny, noting every interesting fact on the accompanying label. Only a small part of his work on this highly interesting subject has been published by the Philadelphia Academy of Sciences, in two papers (in 1869 and 1876), but Dr. Lea made ample provision in his will for the publication of the remainder. His extensive collections of minerals and shells were bequeathed to the National Museum; and the gem-collection, to his daughter, Miss Lea. Two months before his death, I spent two hours with him, examining a series of quartz inclusions, over which he worked with all the enthusiasm and brightness of youth.

"One of the many benefits traceable to the New Orleans Exhibition was the appropriation given to the National Museum for their exhibit. This was wisely expended by Prof. F. W. Clarke in the purchase of a complete series of precious stones, many of which, although not expensive, are still the finest in the United States, from an educational standpoint. Since the exposition many fine specimens have been added by purchase and donation, especially the diamonds and pearls presented by the Iman of Muscat to President Buchanan, consisting of 138 diamonds and 150 pearls, all of good quality. The collection numbers about 1,000 specimens, and embraces almost every known variety of precious stone, many of them in very fine examples."

A Proposed Steel 'Vacuum' Balloon.

The committee of the House of Representatives on acoustics and ventilation has actually reported favorably a bill appropriating seventy-five thousand dollars to subsidize a man who thinks he can construct a steel 'vacuum' balloon of great power. He is to be allowed to use the facilities of one of the navy-yards for the building of his machine, and is to have the money as soon as he has expended seventy-five thousand dollars of private capital upon his air-ship.

One of the mathematical physicists of Washington was asked by a member of Congress whether such a balloon could be successfully floated. He set to work upon the problem, and here are some of his results, which are rather curious: —

A common balloon is filled with hydrogen-gas, which, being lighter than air, causes the balloon to rise and take up a load with it. But, as the pressure of the gas within is equal to the pressure of the atmosphere without, no provision other than a moderately strong silk bag is required to prevent collapse. The inventor of the proposed steel balloon hopes to gain greater lifting-power by using a vacuum instead of gas, the absence of substance of any kind being lighter than even hydrogen-gas. But he has to contend with the tendency of the shell to collapse from the enormous pressure of the atmosphere on the outside, which would not be counterbalanced by any thing inside of it.

The first question which presented itself was, how thick could the metal of the shell be made, so that the buoyancy of the sphere, which would be the most economical and the strongest form in which it could be constructed, would just float it without lifting any load? The computations showed that the thickness of the metal might be .000055 of the radius of the shell. For example: if the spherical shell was one hundred feet in diameter, the thickness of the metal composing it could not be more than one-thirtieth of an inch, provided it had no braces. If it was thicker, it would be too heavy to float. Now, if it had no tendency to buckle, which of course it would, the strength of the steel would have to be equivalent to a resistance of more than 130,000 pounds to a square inch to resist absolute crushing from the pressure of the air on a cross-section of the metal. Steel of such high crushing-strength is not ductile, and cannot be made into such a shell. If the balloon is to be braced inside, as the inventor suggests, just as much metal as would be used in constructing the braces would have to be subtracted from the thickness of that composing the shell. Of course, such a shell would buckle long before the thickness of the metal of which it was composed was reduced to .000055 of its radius. In other words, it is mathematically demonstrated that no steel vacuum balloon could be constructed which could raise even its own weight.

This is an illustration of how intelligently Congress would be likely to legislate on scientific matters unguided by intelligent scientific advice.

Death of Prof. E. B. Elliott.

Prof. E. B. Elliott, actuary of the Treasury Department, died suddenly of heart-disease on Thursday, May 24. He was nearly sixty-five years of age, and had been in the employ of the government since 1861. Professor Elliott was born in Sweden, Monroe County, N.Y., was graduated from Hamilton College, and, after teaching, became interested in the early development of telegraphy, — an interest which he retained as long as he lived. His great skill in making computations led him later to become the actuary of a life-insurance company in Boston, which position he filled until called to a similar office in the United States Sanitary Commission, in 1861.

In 1865 he was secretary of the commission for revising the United States revenue laws, and in 1871 entered the Civil-Service Reform Commission. His service as actuary of the Treasury Department has covered a great amount of statistical and computation work, which has been of the greatest value both to the government and to Congress. Professor Elliott was a member of the American Association for the Advancement of Science, of which he was chosen one of the vice-presidents in 1882. He was always very active, and presided over the section of economic science and statistics. He was also a member of the Washington Philosophical Society, and, at a meeting reviewing the work of the last ten years, it was reported that he had presented more papers to that society in that period than any other member. He was a member of the Cosmos Club and of many foreign learned societies.

He has published a great number of papers on mathematical physics and statistics, and in 1863 was a member of the International Statistical Congress in Berlin. He was greatly interested in horology, and an active member of the American Horological Society. At the time of his death he was engaged upon some important original investigations in that line. He was the first to have a clock constructed with hands to indicate standard time in the different divisions of this continent, long before any one hoped that it would be so generally adopted in the United States.

Professor Elliott prepared the tables of weights and measures in the appendix of Webster's 'Counting-House Dictionary,' and also those constructed on the metric system. He made his greatest reputation by his many valuable statistical reports on coinage, weights and measures, and on bonds. Some of these were published in the last 'United States Census Report,' especially in the volume on vital statistics. He was a very genial and companionable man, rather contemplative, weighing carefully every new fact brought to his attention, and striving to foresee its effects. He will be greatly missed in Washington, and it will be very difficult to fill his place.

The Tape-Worm in Sheep.

Over eighty-five per cent of the sheep examined in Colorado last summer, according to a report made by Dr. Cooper Curtice to the Biological Society at a recent meeting, were infected by a tape-worm which is apparently indigenous to the Western country. Similar parasites had been described in 1856 by Dr. K. M. Diesing from specimens obtained by Natesen from Brazilian deer; but since that time the species was apparently unnoticed. This species is interesting, first, on account of its peculiar anatomy and the life-history of the individual parasite; second, because of the history of this species, which indicates it to be the first acquisition of a native parasite by the sheep on this continent, and its subsequent distribution in the United States; and, third, from an economic standpoint, the discussion of it including a consideration of the disease produced in sheep — the actual loss in death-rate, in wool and mutton, due to the parasite — and of the problem of cure and prevention of the disease.

After describing the parasite, Dr. Curtice said that these tænia occur in the duodenum and gall-ducts of Western lambs and sheep. They sometimes fill each. So tightly do they pack the gall-duct at times, that they cannot be withdrawn without breaking them, and the duct itself is distended by them. The smallest tænia, about half a centimetre long, are always found in the duodenum. They may be found from May to January: no observations were made in the winter months. From the duodenum they pass into the gall-duct, and occasionally into the pancreatic duct. The tænia are usually found in assorted sizes, from the young to the adult, but all may be nearly equal in size. From observations made upon a great number of lambs, it seems that these parasites cannot mature in less than six, or possibly ten months; so that the tænia in lambs would not be capable of infecting other lambs until the former became yearlings. No stages intermediate between the embryo escaping from the parent segment and the tænia five millimetres long were found.

As this species has not been described in Europe, and has not been noticed in eastern United States, it seems to have been acquired by the sheep since their importation into this country. Spanish sheep were first imported about 1820. From the early importation of sheep into Mexico and lower California arose those immense herds of mission sheep, and eventually the millions of sheep now found in the West. These sheep are rapidly being interbred with better grades of Eastern sheep; but the Mexican sheep furnished the material with which the sheep-men of the Plains began. The history of the acquisition and distribution of this parasite is believed, then, to be coincident with the history of these sheep since their arrival in this country. This parasite, originally affecting deer on this continent, is believed by Dr. Curtice to have become ingrafted into sheep, animals with similar life-habits, and, through the favorable conditions of ranching, to have spread rapidly with the increase of the flocks. Its distribution is now from Oregon and Wyoming southward, and Nebraska and Kansas westward.

The disease they cause in sheep makes its appearance gradually, and increases as the parasites grow. It is characterized by a hide-bound, tucked-up condition of the lambs, which is indicative of lean, ill-conditioned animals. Sheep may be apparently strong and healthy, and still harbor a number of these parasites. The poorer lambs generally die from exposure to inclement weather, or from smothering by piling on top of each other in storms in their endeavors to keep warm. The actual loss by death among the lambs is probably the least portion of it; that occasioned by the diminished amount of fat, muscle, and wool, which, though small for each animal, is constantly present from year to year, forms the larger, and aggregates a total loss to the sheep-husbandry of the Plains which is probably greater than that due to the scab-insect.

As yet no effective medicinal remedy for the destruction of these parasites has been discovered. Something may be done in the way of prevention; but, until the complete life-history of the tænia is known, an entirely satisfactory plan of prevention cannot be proposed. At present, watering from troughs instead of from prairie pools, pasturing the lambs on prairie not recently pastured on by older sheep, and, after weaning, removing them to fresh pastures, are recommended. The practice of winter feeding on grain and hay undertaken by ranchmen is especially advisable in keeping up the health of infected animals.

ELECTRICAL SCIENCE.

Long-Distance Telephone-Lines.

IT is known that there is considerable difficulty in transmitting speech by telephones over long distances, unless special precautions are taken in the construction of the lines. Dr. Wietlisbach has investigated the best conditions for telephone-lines, and has arrived at the following laws for the effect of the disturbing causes: —

1. The greater the resistance and leakage, the smaller is the strength of the received current.
2. Self-induction favors high notes.
3. Capacity favors low notes.
4. The resistance diminishes the effect of self-induction, and increases the effect of capacity.
5. Leakage diminishes the effect of capacity, and increases that of self-induction.
6. In a conductor having both self-induction and capacity, the relative intensity of the undulations increases and decreases periodically with the rise in the height of the note.
7. The magnetic permeability and the polarization of the conductor destroy the clearness of the transmission.

If all of the factors remained constant, it would be possible to design a line in which the relations between capacity, self-induction, resistance, etc., were such that all notes would be transmitted with equal clearness. For example: in a submarine cable where the capacity is great, a man's voice is heard farther and more distinctly than a woman's, since capacity favors low notes as compared with high notes; but it would be possible to so increase the self-induction of the line that both would be heard with equal distinctness, and at the same time both would be more perfectly reproduced, since all of the tones would be given their proper relative values.

Unfortunately this cannot be readily done in practice, since the leakage, which diminishes the effect of capacity and increases that of self-induction, is in most lines a quantity which varies with the state of the weather. Dr. Wietlisbach thinks, therefore, that the best way to build a line is to make all of the effects as small as possible, using a looped circuit of copper wire of low resistance and capacity. The empirical rule used in practice is to make the product of the resistance and capacity of any line less than a certain constant which has been determined by experiment. One would suppose, however, that, by roughly adjusting the capacity and self-induction of the line, much clearer speech would result.

POSSIBILITIES AND LIMITATIONS OF CHEMICAL GENERATORS OF ELECTRICITY. — Mr. Francis B. Crocker read a paper before the American Institute of Electrical Engineers with the above title, which cannot fail to be of interest at the present time; more especially as primary-battery schemes seem about to invade this country from what has been until now their home, England. Mr. Crocker first gives the ordinary formula for calculating the electro-motive force from the energy of chemical combinations that go on, — $E = 4.16\ aH$, "where E is the electro-motive force, a the electro-chemical equivalent (grams per coulomb), and H is the number of heat-units (gram-degrees) produced per gram of material by the given combination." It should be pointed out here that this formula is slightly inaccurate, as has been shown by Willard Gibbs and Helmholtz. Gibbs gives it as (putting in the above form) $E = 4.16\ aH\,\frac{T_0 - T}{T_0}$, where T is the temperature of dissociation, and T the temperature of the cell. We would expect, then, that the electro-motive forces obtained from experiment, and those calculated from the uncorrected formula, would be slightly different, the latter being slightly higher. The following table is interesting: —

Metal.	Combining with Chlorine.		Bromine.		Iodine.	
	Calculated.	Determined.	Calculated.	Determined.	Calculated.	Determined.
Magnesium	3.24	3 10	—	—	—	—
Zinc	2.09	2 11	1.63	1.79(?)	1.05	1 25
Cadmium	2.00	1.90	1 58	1.58	.97	1.12
Aluminium	2.30	2.00	1.70	1.53	1.00	.88
Iron	1.75	1 60	1 50	1.30	85	.68
Cobalt	1.64	1.43	—	—	—	—
Nickel	1.57	1 33	—	—	—	—
Tin	1.71	1.61	1.50	1 30	—	—
Lead	1.76	1.63	1.38	1.33	.85	.83
Copper	1.40	1.32	1.07	1.02	.69	.64
Silver	1.25	1.11	.97	.95	.59	.65
Antimony	1.30	1.22	—	—	—	—
Bismuth	1.30	1 21	—	—	—	—

The table of costs is, however, really important, especially to investors. In the table there is given opposite each substance the amount consumed and the cost for a horse-power hour. To find the total cost of a cell, the sum of the costs of its constituents should be taken. These cells all employ zinc as the positive element.

Material: Zinc used with following Electro-Negative or Depolarizing Elements.	Electro-motive Force produced.	Weight of Zinc consumed per Horse-Power Hour.	Weight of Depolarizer consumed.	Total Cost of both Positive and Negative Material per Horse-Power Hour (Zinc costs 7 cents per Pound).
	Volts.	Pounds.	Pounds.	
Free iodine	1.200	1.67	6.53	$22.97
Free bromine	1.790	1.12	2 76	1.12
Free chlorine	2 110	.95	1 04	—
Free oxygen	1.900	1.05	.26	—
Free sulphur	.950	2.10	1.03	.17
Chemical Compounds.				
Water	.500	4.00	1.10	—
Nitric acid	1 900	1.05	2.04	.20
Chromic acid	2 000	1.00	1.03	.28
Copper sulphate (anhyd.)	1.079	1.86	4.55	—
" " crystals	1.079	1 86	7.13	.56
Iron perchloride	1.550	1.30	6.50	.74
Silver chloride	1.060	1.89	8.32	133 25
Mercury sulphate	1 420	1.41	10.70	5 45
Mixtures.				
Potassium bichromate (3 parts), Sulphuric acid (7 parts)	2.000	1.00	5.08	.27
Potassium bichromate (3 parts), Sulphuric acid (4 parts)	2.000	1.00	7.04	.42

In this table the products of the action are not taken into account. In some cases these products would be of considerable value, as

Mr. Crocker points out. There seems in the list no practical battery that will give a horse-power hour for less than twenty cents, — an enormous price compared with the cost of electric energy from a dynamo. One thing must be borne in mind: the cost of materials is obtained from price-lists of chemical companies, and would be materially decreased if the substances were made in large quantities. It will be seen that it will be impossible, however, to reduce the prices, just at present, to compete with a dynamo supplying energy at less than one cent per horse-power hour: so, while primary batteries have an important and extended field for telephonic purposes, telegraph-lines, bells, etc., they can hardly succeed in the more serious work of supplying power and light.

THE SEEL INCANDESCENT-LAMP FILAMENT. — A patent has just been issued in this country for an incandescent-lamp filament which is both novel and successful. The following is the method of preparation: threads of cotton, silk, or other vegetable fibre are steeped in a solution consisting of a silicate or salt, gum-senegal, and caustic soda, and then rolled between warm grooved rollers. The thread is then carbonized in the usual manner. To regulate the resistance of the resulting filament, it is placed in a vessel into which melted paraffine is run, and when the latter hardens an electric current is sent through the filament. As the thread heats, part of the paraffine nearest to it is liquefied, and, as the heat becomes more intense, carbon is deposited on the filament, the solid outer shell of the paraffine preventing any air from getting to it. The resistance gradually decreases as more carbon is deposited. When it reaches its proper value, the current is cut off, the whole of the paraffine melted, and the thread removed. The gum-senegal completely fills the pores of the filament, making it very strong, while the silicate and caustic soda surround the inner core. We have, then, three layers, — the central carbonized thread, the silicate, and the outer layer of deposited carbon.

THE CARRIÈRE ACCUMULATOR. — Several attempts have been made to produce a secondary battery in which the supports are of carbon instead of lead. A great difficulty in the present types of secondary battery lies in their excessive weight, caused to a great extent by the plates used as a support for the 'active' material, the inactive support-plates sometimes making up half the weight of the complete cell. Carbon would, for some reasons, make an excellent support for the active material: it is light, a good conductor, and it is not attacked by the acid in the cell. It has been found, however, that carbon plates will quickly disintegrate when used for battery purposes. If the active material is in cavities in the carbon plate, the expansion on discharge will gradually disintegrate the plate; while, if it is applied on the surface, it will soon drop off. M. Carrière makes his plates especially dense and hard, and, after applying the active material, he puts them horizontally in a cell with cocoanut-fibre between the plates. Whether this peculiar disposition of the plates and their special construction will be effective, can only be determined by experiment.

HEALTH MATTERS.

Wear and Tear of the Medical Profession.

THE State Board of Health of Illinois has recently published a tabulation and analysis of a mass of material which has been accumulating during the past ten years, bearing on the wear and tear of the medical profession of that State. This report, which is written by Dr. John H. Rauch, the able secretary of the board, is a most valuable contribution to the subject, and brings prominently to view the dangers incident to a medical life. Dr. Rauch says that for more than ten years he has been impressed in a general way with a conviction that this wear and tear was underestimated; that the active practice of medicine was not so conducive to longevity as is popularly supposed, nor as writers on such subjects, basing their conclusions on the data obtained from medical biographies, cyclopædias, etc., had been led to believe.

The source of error in this latter instance is obvious. The subjects of biographies, cyclopædia articles, memoirs, etc., are necessarily the men who have attained eminence, or at least prominence; and, in the nature of the case, prominence in the medical profession is largely the fruit of long service and length of days. In other words, the exceptional class which, partly by very reason of long life, has attracted most attention, has been hitherto taken as an indication of the longevity of the profession as a whole. Thus we find one writer (Dr. George M. Beard) citing the deaths of 490 Massachusetts physicians whose average age at death was 57 years, and 35 out of every 100 of whom attained to 70 years. The average age of the subjects of Gross's 'Medical Biography' was 59 years, although it is ingenuously added that these "included several who died before their prime." Similarly Thacher's 'Medical Biography' makes mention of 145 physicians, and the fact that their average age at death was 62.8 years is quoted — as are the other instances — as proof of the longevity of medical men. Still another fact should be taken into consideration in the case of the class who figure in biographies. It is composed very largely of city physicians, and of the men who, in the smaller towns, are in a position to select their practice and adjust their labors with some regard to regular hours of sleep, meals, and relaxation. Comfortably housed at home, properly protected from the weather when making visits, free from the harassing cares of the *res angustæ domi*, and beyond the torturing anxiety which too often besets the struggle for practice, — the conditions of life in these cases are undoubtedly favorable to longevity. But these are the fortunate few, who bear no more numerical relation to the rank and file of the profession than the general officers do to the rank and file of an army.

Compared with these biographical subjects, upon whose length of honorable and successful years is predicated the assertion that the wear and tear of the profession does not prevent its members from attaining a high average longevity — compared with these, Dr. Rauch has, as the result of an extensive correspondence and systematic record, obtained data which show that the average age at death (in Illinois, at least) is not much over 52 years; and that only about 11, instead of 35, in every 100 attain the scriptural limit of threescore years and ten.

In older communities it is entirely probable that this rate may be exceeded. In Massachusetts, for example, the average age at death of 1,166 physicians, occurring during a period of nearly thirty-two years, is given as about 55 years; but the Illinois statistics — collected with painstaking care, and dealing with more than double the number living annually — do not furnish any such favorable result. To a very great extent the discrepancy between Illinois and Massachusetts is due, no doubt, to the different conditions which obtain in the two communities, — the one a comparatively newly settled State, with a population containing less than the normal proportion of the middle-aged and beyond; the other, one of the oldest settled commonwealths, with an excess of ages beyond the middle life, and with what Dr. Holmes calls the "adjustable conditions of living" so perfected as to materially conduce to the prolongation of life. But in addition to this difference there must also be taken into consideration the radical difference in the modes of collecting the data upon which the average age at death has been computed.

For Illinois these data have been obtained through official relations with an aggregate of some 14,000 physicians during a period of over ten years. The *personnel* may be taken as fairly representative of the profession generally, since it is composed of about one-sixth of physicians of a large city, Chicago, and the remainder of physicians of smaller cities and towns. During these ten years there has been an average of 6,000 living per annum, and the aggregate deaths have been about 800, or an annual death-rate of 13.3 per thousand. These round numbers and the period covered are cited to show that the data are extensive enough to insure substantially trustworthy results in the tabulations and deductions.

An examination of the tables shows, that while the death-rate of physicians in Illinois for the first few years after entering upon the practice of medicine is lower than that of all males in Illinois, and greatly less than that of the whole population of the country at large, it increases beyond that of the former class during the decade from 40 to 50, and is greater than that of the latter class in the next decade.

The obvious inference is, that physicians, on entering practice, form a class of selected lives, since they have an advantage of nearly 3 per cent as compared with all males at the same ages, —

that is, from 24 to 40, — and of over 50 per cent as compared with the total population, both sexes, at the same ages; this latter great disparity being no doubt largely due to the casualties among women during the child-bearing period. As the wear and tear of practice begins to tell, this advantage is soon lost; so that during the period from 30 to 70 the death-rate of physicians is 8 per cent greater than that of all males, and during the period from 40 to 70 it is more than 11 per cent greater than that of both sexes.

An examination of the causes of death reveals the result of the exposure, irregular hours, broken rest, and mental anxiety which are the lot of the average practitioner.

In the grouped causes of death it is seen that consumption, diseases of the respiratory organs (including 91 from pneumonia), and Bright's disease caused 268 deaths, or more than one-fourth of the total. If to these be added a share of the deaths from diseases of the heart, — the *sequelæ* of rheumatism, — a fair estimate may be made of the effect of exposure to the vicissitudes of weather upon the wear and tear of medical life. As a result of mental strain and anxiety, of insufficient, irregular, and interrupted sleep, and similar causes, is the total of deaths from diseases of the brain and nervous system, embracing 43 from various forms of paralysis. In the group of zymotic diseases (enteric fever given separately) there were 5 deaths from diphtheria, 1 each from small-pox and yellow-fever, and 8 from traumatic infection (septicæmia, etc.), all contracted from attendance upon patients.

Less creditable to the *morale* of the profession are the 18 deaths from over-doses of opiates and narcotics, the 7 admitted suicides, and the deaths from alcoholism, direct and indirect, — 12 of the former, and at least 8 of the latter. There is this to be said, however, in this connection: that the proportion of mortality from these causes is steadily diminishing; and my observation shows that this diminution is largely the result of an amelioration of the conditions, especially of country practice, due to better roads and methods of locomotion, increased comfort in living, and less physical strain upon the practitioner. Ten years ago the resort to stimulants upon exposure to the weather, and under the harsher conditions of practice which then obtained, was much more common than it is to-day. And this is also true of the use of opiates and hypnotics. The practitioner, familiar with their power to temporarily stimulate to further endurance, or to produce sleep when nervous and exhausted, had formerly greater temptation to resort to the use of these agents, always ready to hand.

While there is a total of 12 deaths reported during the ten years as due to alcoholism direct, there has been only one in the last four years; and of the 18 deaths from over-doses of opiates and hypnotics in the entire period there has been only one in the last three years. In addition to the amelioration in the conditions of practice as a cause of this result, it is only fair to take into consideration also the improved moral status of the profession in this State.

Although the figures and deductions here submitted are believed to be substantially accurate, — being, if any thing, understatements, — they are offered only as a provisional contribution to the study of the subject, which is by no means exhausted. The numbers under observation, and the period covered, are greater than any thing heretofore utilized for this purpose in this country, so far as I am aware, and have cost much labor, which may be materially lightened in the future by very little effort on the part of physicians in making returns of death certificates, and by county clerks in forwarding them to the office of the board. It is hoped that the interest which this presentation of the subject may reasonably be expected to arouse will lead to this result.

Carpet-Beating in Paris. — The Conseil de Salubrité of Paris has prescribed the following conditions under which the beating of carpets will be permitted in the city. The carpets must be brushed and beaten in entirely shut-up rooms, and the dust deposited on the floor will be washed with water containing some disinfectant of potent action. Strips of wool, etc., must be burnt immediately. This action has been taken because of the nuisance caused by the beating of carpets in the open air in the built-up portions of the city, and because of the danger which is believed to exist, due to the fact that many of the carpets come from houses in which contagious diseases have prevailed, and that in the process of beating and shaking the germs are dislodged.

BOOK-REVIEWS.

Discovery of the Origin of the Name of America. By Thomas de St. Bris. New York, Amer. News Co. 8°. 50 cents.

It seems almost as if the sober historian owed his thanks to a class of half-learned wanderers on the outskirts of historical studies, for keeping up with the unthinking a certain factitious interest in early American history, and so to produce readers, who in the end learn to distinguish the limits of historical evidence. One of these happy enthusiasts fabricates as a designation for the precipices of the Hudson the words *L'anormée berge*, and of course finds Norumbega along the Palisades. Another finds a rock in a river, — it is so unusual to find rocks in rivers, — and places Leif's-booths in Old Cambridge, Mass. Another finds 'Amerrique,' or something else, attached to a mountain, or presumably attached, and thinks Vespucius is a humbug. Another finds a Peruvian tribe called by something that sounds like 'America,' and says that the New World was named in that way, it being no matter that the name 'America' was in use for the new continent years before Peru was discovered.

The latest of these whimsical revellers finds, that, after all, Columbus received his reward in having the name of his continental 'find' evolved from 'Amaraca,'— the spot, as he says, where the great navigator first struck the mainland. This last writer has printed a thick pamphlet called 'Discovery of the Origin of the Name of America, — the Most Illustrious Aboriginal National Name of the Continent, by Thomas de St. Bris,'— and undertakes gravely the more difficult task of convincing others, after he has accomplished the far easier one of convincing himself.

The new interest in the study of American history must be accepted, we suppose, with all its train of erratic followers. New interests are always handicapped with such impediments. It is useless to follow Mr. St. Bris in all his gyrations. When he refers to the authority of Wald-see-Müller, and his story of the application of the name of 'America' as history accepts it, there is something delicious in his saying "that ideas of that age were often printed without the slightest reason." We wonder if Mr. St. Bris ever heard that the Spanish Government never recognized during the age of discovery any name for the New World but the 'Indies,' when he tells us that "Charles V., one of the most famous monarchs of the world, gave his western hemisphere one of the most illustrious names of antiquity!" Mr. St. Bris has got yet to learn the alphabet of historical research.

Report of the Dairy Commissioner of the State of New Jersey, 1887. Trenton, State. 8°.

We have had occasion in the past to congratulate the people of New Jersey on the fact, which we think is generally conceded among sanitarians, that the reports published by the board of health of that State occupy the very first rank in the reports of State boards of health; and that the work done by that board in improving the sanitary condition of the State, not alone through the instrumentality of beneficent laws, but also largely through the educational influences set at work by the State board, is of the highest order, and cannot but be of immense value to the State, both in improving the health of its people and the value of its property. To Dr. E. M. Hunt, the secretary of the board, more than to any other one man, is this due. Equally worthy of commendation is the work of Dr. William K. Newton, the dairy commissioner of the State. The report of this officer, which is before us, is the second which has been published. It deals with the subject of oleomargarine, the sale of which is prohibited in the State, unless the seller informs the purchaser what the article is, and presents him a printed notice bearing the name of the article, with milk, and with foods and drugs. Penalties for the violation of the law to the amount of $3,100 have been received during the past year. In the prosecution of those who furnish impure or adulterated milk, $3,900 have been collected in fines. The report contains a number of interesting special reports, among which are the following: 'Testing for Color in Oleomargarine;' 'Lard, its Aulteration and Detection;' 'Condensed Milk;' 'The Composition and Methods of Analysis of Condensed Milk,' by Prof. H. B. Cornwall; 'Honey and its Adulteration;' 'Analysis of Adulterated Honey,' by Shippen Wallace; 'Vinegar and its Adulteration;' 'Canned Foods;' 'Candies;' 'Poisoning from Smoked Sturgeon;' 'Baking-Powder;' 'Bread;' 'The Food at the State Camp;' 'Foods for Invalids and Infants,' by Prof. A. R. Leeds;' 'Estimation of Morphine in Opium,' by Prof. H. B. Cornwall; and 'Notes on Drugs sold in New Jersey,' etc., by August Drescher.

American Fishes. By G. BROWN GOODE. New York, Standard Book Co. 8°.

THIS is a book which every devotee of the rod will be glad to possess. Mr. Goode modestly says in the preface that he yielded to his publisher's request for a 'book about fish and fishing in America,' feeling that he knew more on this subject than on any other. Since 1874 Mr. Goode has been more or less closely connected with the United States Fish Commission, has been abroad as the representative of the United States to the foreign fishery exhibitions, and has in several books and innumerable articles published the results of his observations and investigations. For a time Mr. Goode acted as fish commissioner after the death of Professor Baird, resigning the position only that he might devote all his energies to the National Museum.

In the present volume no attempt is made to cover all of the 1,750 species known to exist on this continent: the object has been rather to give information about every North American fish likely to be of interest to the general reader either on account of its food-value or its gameness. All of this information is couched in such language as to be perfectly intelligible to those not conversant with the mysteries of scientific terminology; and, as the author states, the book is intended for "the angler, the lover of nature, and the general reader." A figure is given of nearly every species, and these figures are most admirable, resembling frequently the carefully prepared drawings of the Fish Commission.

Mr. Goode gives vent to one lamentation in which he will meet the sympathy of those who have had the products of their pens published as public documents. It is probable that most of those who have ever had the curiosity sufficient to induce them to take down from the shelves of some country library one from the rows of mourning-clad volumes of government reports have never gone further than the 'honor to transmit.' One of the chief objects of the author in writing this book was to see some of the results of his twenty years' study printed in substantial and dignified shape. We had never thought of our black-clad friends as lacking in dignity, and they are certainly substantial enough for such use as they get; still the public is to be congratulated on having so well made a book on a subject so ably and successfully handled. It is a book on fish and their habits, and there is no attempt to tell of rods and flies.

NOTES AND NEWS.

THE June number of *The Century* opens with the second of Mr. Kennan's illustrated articles, this one being on 'Plains and Prisons of Western Siberia.' The Lincoln history in this number contains chapters on 'The Advance,' 'Bull Run,' 'Frémont,' and 'Military Emancipation.' The last of the present series of illustrated Western articles by Mr. Roosevelt is entitled 'The Ranchman's Rifle on Crag and Prairie.' Another illustrated article is written by Mr. Theodore De Vinne, printer of *The Century*, and is entitled 'A Printer's Paradise: The Plantin-Moretus Museum at Antwerp.' Mr. Burroughs's appreciative article on 'Matthew Arnold's Criticism,' it seems, had been sent to the printer for the June *Century* before Mr. Arnold's death. In the same number Mrs. van Rensselaer points out some of the errors into which Mr. Arnold fell in discussing American art. Professor Atwater's food-article this month discusses the question 'What We Should Eat.' The fiction of the number includes some chapters of Dr. Eggleston's novel, 'The Graysons.' The concluding portion of Henry James's 'The Liar' is given; with two short stories, 'Selina's Singular Marriage,' by Grace Denio Litchfield, and a love-story, 'By Telephone,' by Brander Matthews. A biographical paper is devoted by Mrs. Herrick to Col. Richard Malcolm Johnston, the Southern story-writer. A portrait of Colonel Johnston accompanies the article. In this number there is another article by Mr. Cheney on bird-songs; there is also a group of poems. —— The June *St. Nicholas* has as a leading article, 'A Great Show,' by Prof. Alfred Church, describing the Circus Maximus at Rome. Thomas Nelson Page continues the serial, 'Two Little Confederates,' and Celia Thaxter contributes a children's story, 'Cat's-Cradle.' 'Caterina and her Fate,' by E. Cavazza, is an old Sicilian legend put into verse, and illustrated by R. B. Birch. Among the lighter features are contributions by Amélie Rives, Emilie Poulsson, Margaret Johnson, Estelle Thomson, Julia P. Ballard, Alfred Brennan, and C. W. Miller. —— Despite the fire, the June issue of *The American Magazine* is a good number. Among the notable features is a paper on 'Our Defences from an Army Standpoint,' by Gen. O. O. Howard; 'The Art of Entertaining,' by Mrs. Gen. John A. Logan; 'Dickens on the American Stage,' by George Edgar Montgomery; and 'Barbados: The Elbow Island,' by Dr. William F. Hutchinson. —— In spite of reports to the contrary, *The Cosmopolitan* magazine will continue to be published. The June number, shortly to be issued, promises to be the best it has ever sent forth. The leading article, upon 'The Romance of Roses,' is an account, by Sophie B. Herrick, of the stories clustering about these universal favorites. It is illustrated by many engravings and by four colored pages.

— Under the head of 'Philosophical Papers, of the University of Michigan,' Andrews & Company, Ann Arbor, are now publishing a second series. These papers were prepared by specialists in the university, under the direction of the philosophical department, and, with but one exception, were read before the Philosophical Society, being selected and edited by Prof. George S. Morris. The series consists of four papers, — 'The Ethics of Democracy,' by Prof. John Dewey; 'Speculative Consequences of Evolution,' by Prof. Alexander Winchell; 'Lessing on the Boundaries of Poetry and Painting,' by Prof. E. L. Walter; 'The Ethics of Bishop Butler and Immanuel Kant' (a thesis for the degree of Ph.D.), by Webster Cook. —— Cassell's 'Pocket Guide to Europe,' the 1888 edition of which is just out, was planned by E. C. Stedman, to meet the demand for a general European guide-book, small enough to be carried easily in a gentleman's or lady's pocket, and yet more complete than any other single-volume guide. It was compiled by Edward King of Paris, who personally went over most of the routes described. It was revised by M. F. Sweetser of Boston, and is re-edited and kept up to date by Mr. Stedman, with the aid of experts in the London office of Messrs. Cassell & Company.

— Senator Edmunds has proposed an amendment to the diplomatic and consular appropriation bill, authorizing the government to expend twenty-five thousand dollars for salaries and expenses of a scientific commission of three persons — to be composed of one officer of the army or navy, a geologist and mineralogist, and naturalist — to visit and report upon the resources of the upper Kongo basin, its products, its minerals, its vegetable wealth, the openings for American trade, and such other information as shall be thought of interest to the United States. Another amendment which he has proposed to the same bill provides an appropriation of ten thousand dollars for salary and expenses of an agent and consul-general at Borna, in Kongo. The President is authorized to detail an army or navy officer for this service.

— The House committee has reported favorably the international copyright bill, that has already been passed by the Senate, instead of the one introduced by one of its own members. This shows a determination to enact this measure into a law during the present session, and a willingness to facilitate its passage.

— The House committee has given a good deal of attention to the proposed survey for the purpose of ascertaining whether the arid lands of the United States are susceptible of being reclaimed or not. Popular interest in this matter is aroused all over the West. No more important subject has been brought to the attention of Congress during the present session.

— The delay of Congress in passing the annual appropriation bills prevents the Bureau of Ethnology from making its plans for the field-work of the present season. This bureau is not established by law, but is kept alive from year to year by special appropriations for its work. While there is no doubt that it will be provided for as usual this year, it is legally impossible to assume that it will in carrying on the work of the bureau.

— Dr. Asa Gray left Harvard College in trust, to aid in the support of the Gray Herbarium of Harvard University, the copyrights of all his books, upon the condition that proper provision be made for the renewal and extension of these copyrights by new editions, continuations, and supplements, such as may be needed in the study of botany, and as may best enhance and prolong the pecuniary value of the bequest.

LETTERS TO THE EDITOR.

**** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

Twenty copies of the number containing his communication will be furnished free to any correspondent on request.

The editor will be glad to publish any queries consonant with the character of the journal.

Fayette County Meteorite.

IN a notice published in this journal Feb. 3, we gave the name of 'La Grange' to this meteorite, overlooking the fact that this name was already applied to the Oldham County (Kentucky) iron. In order to avoid confusion, we would suggest that this name be dropped, and that instead, this meteorite be designated by the name of the county in which it was found (Fayette County, Tex.); and under this title will shortly appear (*American Journal of Science* for June) papers by Mr. J. E. Whitfield of the United States Geological Survey, and Mr. G. P. Merrill of the United States National Museum; the former having worked it up very thoroughly from the chemical side, and the latter microscopically.

They find it to "consist essentially of enstatite and olivine, with a good deal of nickel, iron, and some pyrrhotite." The iron contains over fifteen per cent of nickel, and about two and a half per cent of cobalt.

Since the preparation of these papers, we have cut three slices, an inch and a quarter thick, from the centre of the stone, which enables us to add some interesting facts. The black veins that were observed at several points on the surface are found to extend entirely through the mass, and to be arranged mainly in two sets, in each of which the veins are approximately parallel, the two sets crossing each other at an angle of about 45°. This systematic arrangement of the veins, which may be only accidental, is shown in the accompanying cut, which represents a face of one of the slices.

As the planes of the veins are cut nearly at right angles by the sections, they show on each of them, in approximately the same positions. This is particularly the case with the narrow vein shown at the base of the section. Although only a mere line, it is uniform throughout, and is seen in exactly the same position on all of the sections: therefore we have already revealed the plane of this vein, 15 by 4 inches, with no indications of 'petering out.'

The irregular thick vein also maintains a nearly uniform appearance throughout the four inches of thickness.

The sections also reveal a number of fissures or cracks formed subsequent to the veins, and doubtless at the time of the fall. A dark clouding for the most part surrounds these fissures, the darkest parts being farthest from the fissure, and terminated, in some cases, by a dark line similar to the veins. As all of the fissures are not surrounded by this dark shading, and as some of the clouded spots contain no fissures, it argues that the coloration cannot be the effect of decomposition induced by the cracks, particularly as there is no apparent effect of decomposition extending in from the surface of the stone. The clouding is perhaps older than the cracks, and formed lines of weakness which the cracks followed. Further sections may throw more light on this point.

The general structural appearance of the polished section is that of a fine, compact conglomerate of greenish-gray color. When held so as to reflect the light properly, the grains of iron might, as to number and distribution, be likened to the stars in the Milky Way. Only a few grains attain the size of an eighth of an inch, although two or three grains, composed of iron and troilite, are a full quarter-inch in diameter. Nearly all of the larger grains contain troilite, so that our efforts to develop the Widmanstadtian figures were only partially successful.

In making a mould of the stone before cutting it, the surface was thoroughly oiled, which removed a good deal of the iron-rust, showing much more of the original black crust remaining than could be seen at first. WARD & HOWELL.

Rochester, N.Y., May 24.

An Unusual Auroral Bow.

FOR several years past the 'northern lights' at Buffalo have been a rare meteor. Last evening an unusually interesting display was witnessed. As twilight faded, a luminous bank appeared in the north, which increased in brightness and altitude until nearly midnight. This was accompanied by the usual phenomena of a bright aurora; i.e., a yellowish-green color, long streamers emanating from a bright, irregular arch resting on dark clouds, and the eastward billowy motion of the streamers of light. The most interesting part, however, was an arch which rested its extremities on the eastern and western horizons, and passed at first a few degrees south of the zenith, but which drifted several degrees farther south before final disappearance. This arch formed about 9 o'clock, remained sharply defined until 9.45, and at 10.15 was still faintly visible. Its width appeared to be about that of the rainbow, and it was at first as symmetrical. Subsequently it became somewhat bent, and of irregular width. The bends, convex southward, slowly passed along the bow westward. As it faded out, the extremities were displaced by streamers of light. Those in the east were very distinct, and four or more at a time appeared in this colonnade.

A phenomenon not before witnessed by me was a steady and rapid drifting or flowing of the luminous, cloud-like matter of the arch from the east towards the west. This could be plainly seen by the unaided eye for about forty degrees of the upper part of the band, and any particular cloud would traverse this space in two minutes. D. S. KELLICOTT.

Buffalo, N.Y., May 21.

Positions Vacant.

Inquiries from employers in want of those skilled in any department of science in its widest sense will be inserted in this column WITHOUT CHARGE.

The labor and expense involved in ascertaining what positions are open, in gratuitously advertising them and in attending to the correspondence of applicants, are incurred in the interest and for the *exclusive* benefit of *subscribers* to *Science*.

Applicants should inclose the necessary postage, for forwarding their letters.

1— A Professor will be appointed by the Board of Visitors to the Chair of Biology and Agriculture in the University of Virginia, on the 27th of June, 1888. The emoluments of the position are $3,000 per annum and a dwelling. Inquiries may be addressed to CHAS. S. VENABLE, *Chairman of the Faculty.*

SCIENCE

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SCIENCE

FRIDAY, JUNE 8, 1888.

SCIENCE CAN FAIRLY CLAIM the honor of having placed the discussion concerning the New York public-school system on the proper basis. The task of educating public sentiment has now been undertaken by one of the most influential journals of the metropolis, — the *Sun;* and in the forefront of its discussion, serving almost as the text for what follows, stands our editorial comment of two weeks ago. Educators in all parts of the country are following the discussion in this city with intense interest, and while it is not in our province to enter too extensively into detail, yet we purpose to keep our readers apprised of the progress of the battle; for it is a battle, in every sense of the word, — it is a battle between right and wrong, between educational progress and enlightenment and educational incompetence. The result will be either to free the schools and their hundreds of thousands of pupils from the deadening influence and control of a political ring, or it will fasten that influence and control on them more surely than ever. If the thinking citizens of the metropolis can be brought to appreciate the real nature of the alternative, the result cannot be for a moment doubtful. From all parts of the country, protests should be sent to the authorities in New York in order that they may be made to see that the country's intelligence and the country's conscience are fully aroused in this matter.

IN THE CURRENT ISSUE of the *Forum*, Ex-President Andrew D. White of Cornell has a suggestive article on 'The Next American University.' It is nothing less than the skeleton of a plan for a national examining university, with sufficient funds to bestow fellowships, scholarships, and travelling bachelorships. Its strength lies in its co-operation with existing institutions of collegiate grade. Its weakness, as a plan, is the immense amount of money required to put it in operation. It would furthermore be difficult to select a suitable chancellor, or, at all events, a succession of suitable chancellors, for such an institution, without incurring the hostility or jealousy of some sectarian body or some educational faction. The ordinary college has an historic policy of its own, and the president is to execute and develop it. In such an institution as Mr. White has in mind, the chancellor would be university, policy, and every thing else, so long as he held office. But if the money is forthcoming, let the plan be tried, and let Mr. White be the first chancellor.

THE WASHINGTON SCIENTIFIC SOCIETIES have suspended their meetings for the season after seven months of remarkably successful work. Every session has been well attended, and there have been more papers than there has been time to listen to. Many of these have reported important progress in original investigation, and many others have described work which, although not pushing out into new fields, has perfected and filled up gaps in the work in old ones. The three leading societies — the Philosophical, Biological, and Anthropological — have, by their co-operation, maintained the annual course of Saturday afternoon free scientific lectures. These have all been of a high order, and have been listened to by intelligent audiences that have filled to its utmost capacity the auditorium of the National Museum. *Science* has devoted more attention, and given up more of its space, than usual, during the past few months, to papers presented at the meetings of these Washington scientific societies; and some of our readers may think that we have given them undue prominence, epecially as we have not published the proceedings of scientific societies in other cities. If there are any such, we would remind them that the scientific societies of Washington are unique; they are composed almost entirely of gentlemen employed in the scientific bureaus of the government, many of them engaged in making original researches that could not be carried on by private enterprise because of their great cost. A large proportion of the papers read before the Washington societies are actual reports of progress or of the results of these investigations, and thus anticipate the official reports by months, and often by years.

ONE OF THE MOST INTERESTING features of the very creditable exhibition of the industrial work of the past year in the public schools of Washington, given last week, was what were termed the 'spontaneous' products of some of the pupils; that is, work done outside of the schools. Some of this was suggested by the teachers, and some was not, but in each case it was voluntarily performed by the pupil. One boy, ten years old, exhibited the head of an Indian, a dog, and a horse, modelled in clay, which showed much latent artistic taste and skill. Another boy, twelve years old, made a vase of clay adorned with blooming roses which he had colored. A third boy, ten years old, had modelled a cluster of roses. One of the boys in a higher grade had made an electric bell, a wire from which stretched around the hall, and was operated by means of a button in a distant part of the room. Two other boys, still in the grammar-school, had made two telephones, which were placed at opposite ends of the hall, and which worked perfectly. This 'spontaneous' work, the teachers say, is indirectly the result of the manual training recently introduced into the public schools.

VERY GREAT IMPROVEMENTS have been made in the National Museum at Washington during the last six months. Professor Goode conceives that the object of that institution should be to teach facts in regard to the resources, arts, and industries of the United States, and to a more limited extent of the world, instead of to make exhibitions to please the eye or excite the wonder of the visitor. There are many things in the National Museum that never ought to have been placed there. For instance: there is a cat upon a fence, with the query why she doesn't go over. The reason is shown in the companion object, which shows a large turtle on the tail of the cat. Probably the worst object in the museum is a deer covered with nails. It was probably once owned by some tradesman who dealt in nails, and who covered it with samples of his wares, and placed it outside his door to attract customers. How it came in the National Museum we do not know; but we do know that it ought not to remain there, and shall be surprised if Professor Goode does not soon banish it to the lumber-heap.

THE WEATHER-PREDICTIONS.

THE meteorological work of the Signal Office began in 1870, when an appropriation of $15,000 was made for it. When the weather-predictions were first published, they were looked upon with curiosity and wonder by the people, who were surprised rather that they were verified at all than that they sometimes failed. After eighteen years the weather-predictions have become a part of the every-day necessities of the people of this country. They consult them almost hourly, and by them shape their plans affecting their health, their pleasure, and their business. Instead of

$15,000 a year, the meteorological work of the Signal Office now costs $900,000, and has cost as much as $1,000,000.

In eighteen years, and with such liberal expenditures of money, this service ought to have increased, not only in the extent of its operations, as it has done enormously, but in the character of its work. With so much broader field of operations, the advancement that has been made in meteorological science, and the experience gained in eighteen years, the weather-predictions now ought to be made with much more confidence than formerly, and a larger percentage of them ought to be verified. But such improvement has not been made; at least, not to the extent that it ought to have been. The public have found this out, and, being more critical than formerly, as they have a right to be, complain when they suffer in health, comfort, or pocket through a failure of the predictions to be verified. Why is it, that, while the percentage of successful indications in 1883 was 89.1, it was in 1887 only 73.9, or, allowing for the fact that predictions are now made thirty-two hours in advance, instead of twenty-four as formerly, only 80.9?

Some, but not all, of the reasons are given in the last annual report of the chief signal officer. The indications are not now made by gentlemen who have had sufficient experience. General Greely says, "Within the past three or four years the relief of the old officers detailed from the line of the army has been forced upon the chief signal officer by legislative action. In consequence, it followed that the young officers of the signal corps, who have only within the past year or two received any extended instruction in meteorology, have been assigned to this important duty [of preparing the indications]. Within the past year three officers have necessarily been assigned to indications work who never before have performed duty of this character. It consequently follows, that, through restrictive legislation, the chief signal officer finds himself compelled to permit the new officers to serve their apprenticeship in predicting, at the expense of the whole country. It has occurred, as might be expected, that the novices in the work at times made errors that subjected the service to criticism, which, well merited in such cases, cannot be considered valid criticism of the methods followed by the service. It follows, too, that not every officer who satisfactorily performs practice indications work is well qualified for actual work. Not only is the predicting-officer weighed down with a strong sense of responsibility in the performance of this difficult and vastly important work, but he is also required to decide with as great degree of accuracy instantly, as though he had ample time at his disposal. The officer, as a rule, predicts for forty different districts, for which three elements — temperature, weather, and wind — must be determined. As the time for these predictions is strictly limited, it necessarily follows that each State or district receives less than sixty seconds' consideration at the hands of the indications officer, and each element is predicted with not over twenty seconds' consideration. Officers who have done creditable practice-work have not infrequently failed when called upon to decide instantly and officially future weather-conditions for the whole country."

And again: "The detailed records of this office show how necessary is experience for success in predicting; and it has always followed, that, after a considerable lapse of time in which no work has been done, an indications officer recommences work less successfully and with a very reduced percentage. How essential practice is to success is shown by the comparison of the work years since, when officers continued steadily on this work, with the results of late years, when changes have been frequent and the course of work necessarily broken."

Lack of proper organization of the signal corps is another cause of its failure to meet public expectation. As General Greely says, "Officers and men of the high order of ability and intelligence required by this duty cannot be expected to devote the best years of their life to a service which offers no reward in way of increased rank or pay even for the most valuable work. Poor pay and no possible advance in rank must produce unsatisfactory results. . . . Only two of the original detail remain with the corps, many having voluntarily quitted duty which promised no advancement, and some have gained promotion and reputation in other corps. . . . It is only by long study and great experience that indications officers, who perform the vital work of this service, can expect to be at all efficient in their important duties." Important as this branch of the service is, touching as it does so many vital interests of the people, Congress has always neglected to give it proper attention. In more than eighteen years no separate and distinct law affecting the Signal Service has been enacted. The only legislation regarding the corps has been in the shape of 'riders' upon appropriation bills, which, as a rule, have not had proper consideration. The law of 1866, re-organizing the army, directed the detail of six officers and one hundred men from the engineer corps. No engineer officer has ever been detailed to the signal corps. The same law provided that no officer or man should be detailed without examination and approval by a military board. This mandate has also been ignored. Under a perversion of a law of 1878, civilians have been enlisted as privates, promoted the same day to be sergeants, commissioned the next day to be second-lieutenants. and sent into the signal corps without examination of any kind, and without having served a day in the corps, to take the places of experienced men who have thus been crowded out and sent back to their regiments.

Although the Signal Service is one dealing entirely with physics, until General Greely, then a subaltern, urged the importance of it, no question bearing on the natural sciences was ever put to any sergeant examined for promotion. The result is that some of the second-lieutenants of the signal corps are officers whose mental qualifications and natural ambitions will insure their remaining in the service even under a rigid examination; while there are two other classes, one of which consists of young men, whose natural aptitudes tend rather in the direction of the line of the army than with a strictly scientific corps. The mental abilities, general education, or moral standing of the third class is such that it cannot be reasonably expected that they would ever serve with marked credit either in the line of the army or in the signal corps. General Greely has said officially that the records of the office show that the senior officer in the signal corps, next to the chief signal officer, has never been able to attain such a knowledge of the methods and work of the Signal Service as has always been exacted from every sergeant in the corps; this despite the fact that the officer in question received the most careful instruction, covering a period of nearly two years, and was thrice examined on questions which were substantially the same.

Nor has the whole story yet been told. The present secretary of war has never shown any interest in the Signal Office, and has seconded none of the efforts of the chief signal officer to improve the service. A bill, prepared by General Greely, to re-organize the corps and correct the abuses (for they are nothing less) described above, was not approved by Secretary Endicott, who seems only anxious to get rid of the bureau, and not to care how greatly demoralized it may be. The Senate in the last Congress passed a bill to transfer the Signal Office to a civil department; but it failed in the House, which already this session has incorporated in the bill creating a Department of Agriculture, which it has passed, a provision transferring this bureau to that branch of the government. In both cases it is provided that the officers now on duty in the Signal Office, with all their good qualities and defects, shall go with the service without prejudice to their commissions: in other words, although it is proposed to make the bureau a civil one, yet the officers are still given an immovable tenure of office, without discrimination being made between the worthy and the incompetent, — a perpetuation for an indefinite time of the present extravagant, inefficient, and demoralized organization of the office. Against this, General Greely protests, and asks Congress to re-organize the service whether the transfer is made or not, cut down the expense of it $100,000 or $125,000 a year, and give him a chance to make it perform its work as it should do, and as Congress has a right to expect it to. But his bill and communication receive no attention from the committee of either House. Mr. Hatch, chairman of the House committee that reported the bill which has passed that body this session, has never been to the Signal Office to learn any thing about the service, or communicated with the chief signal officer as to the needs of the service. He simply attached the provision making the transfer to the Agricultural Department bill without knowing what its effect would be. The first result of the enactment of the bill into a law will be the necessity of appropriating $65,000 additional a year to man the military telegraphs, which will then be left without an operator, instead of saving $125,000.

Is it any wonder that the weather-predictions are not always verified? General Greely, confident that the Signal Office will soon be transferred to a civil department, in loyalty to the government, began, at the opening of the present fiscal year, some preparation for it, especially by training civilians in weather-predictions, detailing one on each alternate month. Professor Abbe was performing this duty in March; and although years ago, when he had long-continued practice, he was remarkably successful, he failed to foretell the great blizzard, of which something certainly ought to have been known in advance. Similar conspicuous failures this year may be explained in the same way.

A word ought to be said about the cold-wave predictions. These are an extension of the service within the past few years, and, as a knowledge in advance of sudden great changes of temperature is of great importance on account of its bearing on the health of the people and the safety of many kinds of property, these reports, a very large percentage of which have been verified, have become very popular.

THE POLYTECHNIC INSTITUTE.[1]

EVERY middle-aged inhabitant of the British Islands must recall more than one occasion when the mind of our country has been strongly stirred on the question of national defence. The adverse evidence of an expert, a rousing article in a newspaper, has often awakened general anxiety of more or less continuance, and been followed by more or less adequate results. But it is far more difficult to awaken any widespread concern on behalf of those great abiding national interests which it is our charge and heritage to defend. And yet there are signs of no uncertainty which must to all thoughtful and instructed minds, from many directions, suggest the question whether that industrial leadership which has hitherto made our small and crowded country the world's workshop, and almost the world's mart, is not slipping from us. This is a question not of more or less wealth or luxury, but of very livelihood to the masses of the people under the special conditions of our national existence. If work ceases to come to a workshop, there is nothing for it but prompt dispersal of the workmen. All authorities seem agreed that the population of five or six millions inhabiting England and Wales in the time of Queen Elizabeth represents pretty nearly what their areas can sustain as agricultural, self-supporting countries. But the population of England and Wales alone was shown by the census of 1881 to have reached nearly twenty-six millions; so that seven years ago there was in the southern half of Great Britain an excess of twenty millions above what the country could reasonably support, except as a community of artificers and traders, and general carriers, by import and export, of the world's merchandise. It needs only a glance into past history to see that this, while an enviable position for a nation while prosperity lasts, is practical extinction when the channels of commerce are turned, or lost advantages have transferred production to new centres. Macaulay's fancy picture of the New-Zealander sketching the ruins of St. Paul's from the broken arches of London Bridge seems of very little concern to the present citizen, whose ears are deafened with the ceaseless roar and traffic of the streets. And yet precisely that doom of silence and decay has befallen many a proud mother-city of which now "even the ruins have perished." It would far exceed present limits to show in detail how many articles of our own immemorial production we ourselves now largely import, because the foreign workman produces them better, or produces them at less cost. The evidence will be fresh in the recollection of the readers of this journal. Neither can they fail to recall with what persistence we have pointed out the remedy. There is but one real remedy, — the better training of the workman, and — if we may be allowed to say it — of his employer too. Every one who, without prejudice, has opportunity to watch a fair specimen of the British workman at his work must admit that the raw material is as good as ever it was; that, in the quantity and quality of the work he can turn out in a given time, few of any nationality can equal, and none surpass him. But in the training he receives, and in the opportunities of his receiving it, there is much left to be desired. And meantime there is not only the grave fear, but in many branches of industry the accomplished fact, that other nations may and do outstrip us in the race.

[1] From *Nature* of May 24, 1888.

Perhaps there is some belated merit in seeing that now; but all honor to those who, with heart and means to labor towards the better training of our artisans, devoted themselves to the endeavor when the need for it was less comparatively obvious. Honor especially to one man, Mr. Quintin Hogg, who, close upon a quarter of a century ago, at an age when most young men are concentrating their best energies on cricket, or foot-ball, or lawn-tennis (all good things in their way), made it his life's task to raise the skilled workman of London, and furnish him more fully for his labor, for his own sake and for ours. Probably most of our readers know how that small enterprise has become a great one indeed, with the old Polytechnic for its present home and centre, and with a fuller variety of classes and branches, and with a greater comprehensiveness of scheme, than we can now attempt to describe. But all has hitherto rested on the shoulders, and been sustained by the purse, of Mr. Hogg himself, who, during the past six years, has spent, speaking broadly, some £100,000 in establishing and sustaining these admirable schools. But the time has now come when so great a burden, for the work's sake as well as for his own, should no longer depend upon the means and life of a single man; and there is now an opportunity of securing for the institute something like an adequate endowment. The charity commissioners have offered to endow it with £2,500 per annum on condition that the public find £35,000 as a supplementary fund. £18,000 have already been promised by the personal friends of the founder; but £17,000 still remain to be raised, — a large sum, no doubt, but a small one compared to our still unrivalled resources, and the national value of the institute, not only for its own immediate results, but as a model for similar efforts in all the great centres of our industry. Those who believe in science — that is, in faithfully accurate and exact knowledge — as the only sure basis for any national prosperity that is to bear the stress of the fierce competition of our times, are earnestly invited to make themselves acquainted with the work of the institute, and to contribute to its funds. Eighty-one thousand members and students have joined since it was moved to the Polytechnic, 309 Regent Street, in 1882. All donations or subscriptions will be thankfully received there, or by Mr. Quintin Hogg, 3 Cavendish Square, W.

SCIENTIFIC NEWS IN WASHINGTON.

Tricks of Indian Jugglery. — The May Fogs on the Atlantic.

Indian Jugglery.

THE feature of the evening at one of the late meetings of the Anthropological Society was a paper by Col. Garrick Mallory on 'Algonkin Glyphs on Bark and Stone.' The paper also dealt briefly with some related subjects, and will form a part of the annual report of the Bureau of Ethnology. The following is a brief chapter on 'Indian Jugglery,' extracted from this paper: —

"Paul Beaulieu, an Ojibwa of mixed blood, present interpreter at White Earth Agency, gave me his experience with a Jossakeed, at Leech Lake, about the year 1858. The reports of wonderful performances reached the agency, and, as Beaulieu had no faith in the jugglers, he offered to wager one hundred dollars, a large sum, then and there, against goods of equal value, that the juggler could not perform satisfactorily one of the tricks of his repertoire to be selected by him (Beaulieu) in the presence of himself and a committee consisting of his friends.

"The wager was accepted, with the result to be described.

"A medicine lodge was made. Four strong poles were planted deep in the ground, rising to an elevation of at least ten or twelve feet; one of them having the branches remaining and rising a little beyond its fellows, this being the indication of a Jossakeed as distinguished from a Medé lodge. The interior diameter was less than four feet. The frame, which was inclined to the centre, was then filled in with intertwined twigs, and covered with blankets and birch-bark from the ground to the top, leaving an orifice of about a foot in diameter open for the ingress and egress of spirits and of the objects to be mentioned, but not large enough for the passage of a man's body.

"At one side of the bottom wrapping a flap was left for the entrance of the Jossakeed or Shaman.

"A committee of twelve was selected to see that no communication was possible between the Jossakeed and confederates. These twelve men were reliable people, one of them being the Episcopal clergyman of the reservation. The spectators were several hundreds in number, but stood off, not being allowed to approach.

"The Jossakeed then removed his clothing, until nothing remained upon his person but the breech-cloth. Beaulieu then took a rope (of his own selection for the purpose), and first tied and knotted one end about the ankles; the knees were then securely tied together; next the wrists; after which the arms were passed over the knees, and a billet of wood passed under the knees, thus securing and keeping the arms down motionless. The rope was then passed around the neck again and again, each time tied and knotted, so as to bring the face down upon the knees.

"A flat river-stone of black color — which was the Jossakeed Manedo or amulet — was left lying upon his thighs. The Jossakeed was then carried to the lodge, placed inside upon a mat on the ground, and the flap covering restored so as completely to hide him from view.

"Immediately loud thumping noises were heard, and the framework began to sway from side to side with great violence; whereupon the clergyman remarked that this was the work of the Evil One, and it was no place for him: so he left, and did not see the end. After a few minutes of violent movements and swaying of the lodge, accompanied by loud inarticulate noises, the motions gradually ceased, when the voice of the juggler was heard telling Beaulieu to go to the house of a friend near by, and get the rope. Now, Beaulieu, suspecting some joke was to be played upon him, directed the committee to be very careful not to permit any one to approach while he went for the rope, which he found at the place indicated, still tied exactly as he had placed it about the neck and extremities of the Jossakeed. He immediately returned, laid it down before the spectators, and requested of the Jossakeed to be allowed to look at him, which was granted, but with the understanding that Beaulieu was not to touch him.

"When the covering was pulled aside, the Jossakeed sat within the lodge, contentedly smoking his pipe, with no other object in sight than the black stone Manedo.

"Beaulieu paid his wager of one hundred dollars. An exhibition of similar pretended powers, also for a wager, was announced a short time later at Yellow-Medicine, Minn., to be given in the presence of a number of army people; but at the threat of the grand medicine-man of Leech Lake bands, who probably objected to interference with his lucrative monopoly, the event did not take place, and bets were declared off.

"At Odanah, on the Bad River Reservation, and at Bayfield, both in Wisconsin, I obtained some variants of the above performance as seen at different times and places and by several witnesses. For instance: the Shaman at one time was tied up much as before mentioned, but with all of his clothes on; a fish-net, however, being tied above his clothes, enveloping the whole person; and horse-bells were attached to his body, so as to indicate any motion. When examined afterwards, the clothing had been entirely stripped from his person, the nets and ropes and bells placed in a separate pile in the lodge, and the clothing itself was found by direction under a designated tree a mile off; the Indians of the committee, one of whom was my informant, running from the lodge at their highest speed to the tree, and there finding the clothing, and stating the impossibility of its being transported by any human agency in advance of their arrival. In another case, occurring at night, two lodges were built about twenty feet apart. About a hundred Indians surrounded the space occupied by the two lodges with lighted torches giving the brightness of day, and a line of bonfires was built and kept in flame over the space intervening between the two lodges. The levitation in this case was by the bound Shaman in one lodge being found unbound in the other.

"It should be noted that these stories relate to a time some forty or fifty years ago, before the tricks similar to those of the Davenport brothers had become known in the civilized portions of the United States. It is a still more important fact that the French missionaries in Canada, and the early settlers of New England, describe substantially the same performances when they met the Indians, all of whom belonged to the Algonkin stock. So remarkable and frequent were these performances of jugglery, that the French, in 1613, called the whole body of Indians on the Ottawa River, whom they met at a very early period, 'the sorcerers.' They were the tribes afterwards called Nipissing, and were the typical Algonkins. No suspicion of jugglery in the sense of deception appears to have been entertained by any of the earliest French and English writers. The severe Puritan and the ardent Catholic both considered that the exhibitions were real, and the work of the Devil. It is also worth mentioning that one of the derivations of the name 'Mic-mac' is connected with the word meaning 'sorcerer;' so that the known practices of this character having an important effect upon the life of the people extended from the Great Lakes to the extreme east of the continent. It was obvious to me, in cross-examining the various old men, that the performances of jugglery were in each case an exhibition of the pretended miraculous power of an individual, whereby he obtained a reputation above his rivals, and derived subsistence and authority, by the selling of charms and superhuman information. The charms or fetiches, which still are sold by a few who are yet believed in, are of three kinds, — to bring death or disease on an enemy, to lure an enemy into an ambush, and to create sexual love."

The Unusual Prevalence of Fog during May.

The belt of frequent fogs during the past month, as shown graphically on the Pilot Chart for June, extended well up into the Gulf of St. Lawrence, and across the Atlantic from shore to shore. While the amount encountered off the Grand Banks and the coast to the westward is but little in excess of the normal for May, yet such great frequency of dense fog-banks east of the 40th meridian is very unusual. It may be attributed almost entirely to the unusual prevalence in that quarter of the ocean of southerly winds, which lasted for fourteen days during the first two decades of the month. These winds bring the warm, moist atmosphere from lower latitudes far to the northward, and into contact with the colder air of more northerly regions, this contact resulting in the precipitation of the moisture in the form of fog. Adding to this the fact that most of the depressions noted during the month passed well north of the 50th parallel after reaching the 40th meridian, thus lessening the clearing effect of their north-westerly winds, it will be seen very readily that the conditions were peculiarly favorable to the development of fog along the transatlantic routes.

Early in the month, small patches of fog were reported, also, to the westward of Bermuda, about the 70th meridian, accompanying north-westerly winds blowing toward a slight depression in about 32° north and 63° west, on the 2d and 3d. The dense fog along the coast north of Hatteras on the 6th, which led to the collision between the British steamship 'Benison' and the American steamship 'Eureka,' by which the latter was sunk fifty-six miles east-south-east from Cape Henry, was due to the prevalence of southerly winds in the western quadrants of an area of high barometer about the Bermudas, which, blowing up the coast from over the Gulf Stream, came into contact with the cold water of the inshore current, with the usual result.

MENTAL SCIENCE.

Illustration of the Play-Instinct.

An article entitled 'The Story of a Sand-Pile' would not at once suggest any thing of interest to the psychologist; nevertheless the story as told by Prof. G. Stanley Hall (*Scribner's Magazine*, June, 1888) is full of suggestiveness to one approaching the study of mind with an appreciation of all the various aspects that mental phenomena assume in the world of nature. The story of the 'sand-pile' tells of two boys who had the advantage of playing with a load of sand placed for that purpose in the back-yard. This at once became the centre of all their interests, and by a gradual growth assumed the appearance of a miniature community. Roads were laid out, coal placed in the ground to be afterward discovered, and a sort of cave-dwelling erected. The next summer the evolution went on, fortunately undisturbed by parental suggestions.

The house became a board with another slanted against it; then it was two bricks and a board on top. A bit of wood suggested to one of the boys a horse, and that became a horse; others being made like it, at first very rude, and afterwards with all the refinements that a scroll-saw could add. Cattle were made and added to the houses, there being a remarkable conservatism in adhering to an original model, though the boys were able to do better work. Before many summers there was a community modelled quite closely after the village in which they lived: crops were raised, stacked, and sold, as in town. Furthermore, the men and women of the 'sand-pile' were named Bill Murphy, Charles Stoughton, Peter Dana, etc., — names of real men in the village; and the personality of the real individual, that of the puppet and of the boy who owned it, — for other boys had been admitted by this time, — were strangely confused. If the real Farmer Murphy had done any thing disreputable, the boys threatened to suspend the boy who owned the puppet Farmer Murphy from the 'sand-pile.' The boys take their men along in their pockets on a pleasure-trip, send them in letters to distant friends to have them returned, and be said to have seen distant places. "The best man has travelled most, keeps his farm in the best order, has most joints in his body, keeps dressed in the best coat of paint, and represents the best farmer in town, and is represented by the best boy."

The industrial evolution of this agricultural community strikingly reminds one of the real evolution in the history of the race. The plough, the wagon, and so on, can be seen in the several stages paralleled by the relics in museums. The political organization reflects that of the town, as well as that of primitive communities. Money was first made of a kind of card-board, but, owing to the possibility of counterfeiting, felt gouged out by an instrument was substituted. At the beginning of the season ninety dollars and fifty half-dollars were given to each boy. So real were these coins to them, that silver is said to have been refused for the felt, the varying intensity of the play-spirit being recorded in the silver value of the felt money. When a grocer — the youngest boy — failed, he was at first aided, and then meetings held to consider the case. "One proposition was a general *pro rata* subscription; another was a communistic redistribution of the money of the community. These schemes were successfully opposed, however, and it was at last agreed to inflate their first currency by issuing enough money to give each boy an additional sum of ten dollars. While this matter was under discussion, and redistribution was expected by some, prices were affected, and a few sales were made at prices so high as to cause embarrassment later."

As the boys grow older, the institution begins to lose its reality, and the circle of their interests changes. Moreover, "the golden age of this ideal little republic has already passed," and "a period of over-refinement and enervating luxury" is likely to end its career. Self-consciousness and the desire for approval replaced natural interest. The parents regard the educational advantages of this 'sand-pile' as outweighing the eight months of school-work: it cultivates co-operation, justice, and reflection; leads to industrial skill, saves idleness, and prevents bad habits. Its educational import is thus characterized by Professor Hall: "Had the elements of all the subjects involved in the 'sand-pile' — industrial, administrative, moral, geographical, mathematical, etc. — been taught separately and as mere school-exercises, the result would have been worry, waste, and chaos. Here is perfect mental sanity and unity, but with more variety than in the most heterogeneous and soul-disintegrating school-curriculum. The unity of all the diverse interests and activities of the 'sand-pile' is, as it always is, ideal."

HEAD-GROWTH IN CAMBRIDGE STUDENTS. — Mr. Francis Galton makes an interesting report on measurements of the heads of Cambridge (England) students, which we owe to Professor Venna (*Nature*, May 3). What is called a 'head-product' may be fairly regarded as representing average brain-volumes. It is obtained by multiplying the maximum length of the head by its maximum breadth and its maximum height above a certain plane. This result represents the contents of a rectangular box that would just fit over the head. This is only rudely proportional to the brain-mass in individuals, but would be closely proportional to it in the average of many cases. The result of the measurements, which have been taken within the last three years, is as follows: —

Ages.	Class A. 'High-Honor' Men.	Number of Measurements.	Class B. The Remaining 'Honor' Men.	Number of Measurements.	Class C. 'Poll' Men.	Number of Observations.
19	241.9	17	237.1	70	229.1	52
20	244.2	54	237.9	149	235.1	102
21	241.0	52	236 4	117	240.2	79
22	248 1	50	241.7	73	240.0	66
23	244 6	27	239 0	33	235.0	23
24	245.8	25	251.2	14	244.4	13
25 and upwards	248 9	33	239.1	20	243.5	26
		258		476		361

In spite of many irregularities, the following conclusions may be fairly deduced from these figures: (1) that while, in the population at large, brain-growth ceases after the age of nineteen, this is not true of university students; (2) that men who obtain high honors have considerably larger brains at nineteen years than those who do not; (3) that this predominance is reduced to about half its extent at the age of twenty-five, the brain of the 'high-honor' man increasing by about three per cent, that of the 'poll' man by about six per cent, in this period; (4) that the 'high-honor' men are presumably a class both more precocious and more gifted than the others.

AN INTERESTING MEMORY-TEST. — Mr. H. H. Ballard publishes in the *Journal of Education* for May 3 the result of a test of the memories and receptive powers of school-children. The sentence, "Your redemption from the distress into which you have fallen is in your own hands, and in no wise depends on forms of government or modes of election," was carefully read to one of ten selected pupils, who repeated it as exactly as possible to the next scholar, and this one to the third, and so on to the tenth. The tenth pupil wrote down what he received from the ninth. In one case the sentence emerged from this process as, "The redemption of your distress is in your own hands;" in another it was, "The invention which has fallen into your hand;" and the sentence had dwindled into this already at the sixth pupil. In another case the sentence was whispered instead of distinctly read, and the process of calling on the imagination when the senses give no clear impression is illustrated in the result, which was, "The attempts into which we have fallen during the government election are very low." In the Pittsfield, Mass., High School the sentence reduced to, "Redemption is in your own hands, and depends upon no formal government nor love." In the senior class of another high school, in which the average age of the pupils was eighteen years, the result was, "Our redemption for our destruction has nothing to do with us." In still another high school it was, "Your distress into which you have fallen is by no means the fault of government." A set of eight-year old pupils reduced it to, "The redemption that lies in your hand is done;" and the first class of the high school in the same town made it, "Your redemption into which you have fallen is your own fault." In one school the experiment was modified: two pupils from each of five grades were selected, and the sentence clearly read aloud to them all. After a minute's interval, each of the ten wrote down what he could of the sentence. The sentences written by one pupil of the highest, one of the middle, and one of the lowest grades were these: "Your redemption from the distress into which you have fallen lies in your own hands, and in no wise depends on the government or manner of election;" "Your redemption from the distress into which you have fallen is in your own hands, and depends in no wise upon the forms of government or the modes of election;" "Your redemption and distress in which you have fallen depends on yourself, and in no wise on the government or its mode of election." Although not one of the ten got it perfectly accurately, yet many were very near it; and they all show how much more the wear and tear on the sentence is in passing through ten mouths than through one. By the other process one accumulates the combined inaccuracies of all, and one pupil with a very poor receptive organ in the middle of the ten prevents the circulation of a good repetition after him. After this the sentence was passed through the ten pupils arranged in order of grade, and issued as, "Your redemption from the distress into which you have fallen depends entirely upon yourself, and by no means upon the forms of government or helps from education." The sentence here selected is quite a difficult one, but an easier one from Emerson was hardly more successful. The sentence was, "All things are double, one against another, — tit for tat, an eye for an eye, a tooth for a tooth, blood for blood, measure for measure, love for love," — and the result, "All things are good for one another." Although the test, as thus applied, is too complex to allow valid inferences to be drawn from it, it at any rate shows how difficult it is to repeat accurately what has been heard, as well as how little confidence is to be placed in the declarations of persons reporting the very words of a conversation held weeks or months before; it illustrates, too, in a simple form, the process by which a simple tale becomes an elaborately embellished narrative by passing through several hands; and perhaps it indicates that the powers of careful attention and retention need more systematic training than is devoted to them in the ordinary school-work.

HEALTH MATTERS.

SEA-SICKNESS. — Dr. W. H. Gardner, U.S.A., in a letter to the *New York Medical Record*, reports having treated many cases of sea-sickness with oxalate of cerium, in ten, fifteen, or twenty grain doses, every two or three hours. He believes that seventy-five per cent of all cases that occur will be cured by this remedy. As many of our readers are about to leave the United States for a summer's jaunt in Europe, an admirable opportunity presents itself for testing Dr. Gardner's remedy. As oxalate of cerium is a recognized drug to be administered in cases of nausea and vomiting, we see no reason why it should not be efficacious in sea-sickness.

FUNCTION OF THE BILE. — Among the many mooted questions in physiology is the function of the bile, and every new fact bearing upon this important subject is of great value. Dr. Dastre, as reported in *Le Progrès Médical*, recently communicated his observations to the Société de Biologie of Paris. He said that he had previously proven that the presence of bile in the stomach during different periods of digestion did not take from the gastric juice its digestive power: consequently it could not be the cause of vomiting or of severe gastric troubles. At the present time, owing to the success of two operations for cholecysto-intestinal fistula, he thought himself in a position to conclude that the bile contributed, as well as the pancreatic juice, to the digestion of the fats, — an opinion which is counter to that expressed by Claude Bernard. In fact, the two animals being in good condition four months after the establishment of the fistula, they had been given a meal of fat and milk, and then slaughtered during full digestion. The examination showed with absolute clearness that the lacteals were transparent between the stomach and fistula, and, on the contrary, entirely white and milky below the fistula; that is to say, where the bile had been able to get: consequently, if observation on the rabbit shows us that the bile alone is unable to emulsify the fats, the preceding experience shows us that the pancreatic juice alone is also powerless. They must be mingled, in order to act well. In other words, bile, as well as the pancreatic juice, takes part in the digestion of fats.

A NEW HYPNOTIC. — In the *New York Medical Record*, Dr. E. C. Wendt describes sulfonal, a new hypnotic. Chemically this substance enjoys the euphonious designation of 'diæthylsulfondimethylmethan.' It occurs in the form of large, flat, colorless crystals, which are tasteless, and devoid of smell. Sulfonal is soluble in eighteen to twenty parts of boiling water. In tepid water the solubility is only about one to one hundred. The crystals dissolve more readily in alcohol and alcohol mixed with ether. Acids and alkalies do not affect the composition of the body, which appears to possess considerable chemical stability. The crystals melt at a temperature of 275° to 260° F. According to Professor Kast of Freiburg, sulfonal is an hypnotic pure and simple. It does not compel sleep through a paralytic effect on the nerve-centres, nor through a profound impression produced upon the vascular system. From numerous experiments on animals, and many clinical observations on man, the action of this new remedy would appear to consist merely in the intensification of those factors that lead to natural sleep in the physiological sense, or in supplying the periodical desire for sleep in those cases where it is wanting. It is for this reason, probably, that the range of applicability of sulfonal is a more limited one than that of some other drugs employed as hypnotics. But sulfonal has none of the disadvantages inherent in the deadly narcotics, and it is much more reliable than any of the bromides. This new body does not disturb digestion, it is not constipating, it has no unpleasant after-effects, it is perfectly harmless, it does not invite the formation of 'a habit,' and, finally, it does not appear to lose its efficacy even when employed for a long period.

SMOKERS' VERTIGO. — Dr. Decaisne is reported in the *New York Medical Record* as having recently investigated a number of cases of vertigo in smokers. Out of sixty-three patients, forty-nine were between fifty and sixty-six years of age. More than half of them suffered, in addition, from digestive troubles, with constipation alternating with diarrhœa, insomnia, palpitations, dyspnœa, and diuresis. In a third of the number there was marked intermittence of the pulse, and granular pharyngitis, while others suffered from aphthæ, amblyopia, etc. Thirty-seven were persons who smoked habitually on an empty stomach; and these suffered from vertigo, principally in the morning. The vertigo generally coincided with suppression of perspiration and diminished excretion of urine. The treatment consisted mainly in regulating or suppressing the cause, but thirty-three out of thirty-seven patients ceased to suffer on merely refraining from smoking on an empty stomach.

A LEPER INVASION OF THE UNITED STATES. — It is reported that many lepers are leaving the Sandwich Islands, as soon as the disease manifests itself, in order to prevent being banished to the island of Molokai. Mr. Putnam, consul-general at Honolulu, believes the number of these emigrants to be considerable, and many if not most of them flee to the United States.

RACE AND INSANITY. — In an article entitled 'Race and Insanity,' published in the *American Journal of Insanity*, Drs. Bannister and Hektoen, physicians of the Illinois Eastern Hospital for the Insane, express the opinion that there is little doubt but that insanity is influenced by race. From the statistics of three institutions in which insane persons are treated they draw the following conclusions: 1. That in the white race the depressive types of mental disease are most frequent in the Germanic and Scandinavian peoples, and least so in the Celts: the reverse of this appears to be the case as to the exalted or maniacal types. 2. That general paralysis is not a disorder to which any race is immune, but one that depends upon causes independent of racial or national peculiarities. 3. That the well-known fact that insanity is much more common amongst the foreign-born than amongst natives in this country, is not to any great extent explainable by the shipment of the defective classes of Europe to America. The 'cranks' and epileptics and other neurotic individuals do not appear to be represented, in due proportion even, amongst the foreigners in our asylums. The cause of the excess of foreign-born insane in this country is, it seems probable, to be looked for mainly in the fact, that, supposing the immigration to include only its proportion of persons below the average of mental strength and flexibility, the change of scene and associations, the difficulties of beginning life among them, disappointments, homesickness, and all the other accidents and trials that befall the new-comers, together contribute to break down mentally a vast number who under other circumstances would have escaped, and largely contribute to the mass of insanity in this country.

ELECTRICAL SCIENCE.

Alternating-Current Electro-Motors.

TWO inventions that will greatly modify and improve the conditions of electrical distribution have been for some years past the subject of much thought and experiment among electricians. They are the secondary battery and the alternating-current electro-motor. To-day there are secondary batteries in use, and there are alternating-current motors, that will run with some degree of success; but improvement is necessary in order that they may be adapted to extensive operations, and it is only a matter of time when these improvements will be made.

The Tesla electric motor, of which a brief description has appeared in this journal, seems the most successful attempt that has been made for the distribution of power by alternating currents. The difficulties in the way of such a motor are these: it must start with the maximum turning effort; when it attains its proper speed, it must regulate itself for varying loads; and it must be made to work under constantly changing load; and all these requirements are difficult to fulfil in the same machine. In one form of motor Mr. Tesla obtains synchronism between the revolutions of the armature and the reversals of the feeding dynamo; that is, it regulates itself. This form has little or no turning effort at the start. In another type a considerable turning effort is obtained, but there is no regulation. By combining the two characteristics, a motor is produced that will start, and when it arrives at its proper speed will regulate, itself. This seems the most plausible plan that has been yet suggested for the purpose. It will be remembered that the motor presents the peculiarity of having no connection between the armature-coils and the external circuit, currents being induced in the former by the alternations of the field-currents, and so is the simplest mechanical and electrical arrangement possible.

In a paper read before the Institute of Electrical Engineers, Mr. Tesla explained the system, but unfortunately gave no data as to the efficiency, output, etc., of the motors. Such data will probably be forthcoming, for such a promising invention cannot but be given an exhaustive trial; and it is to be hoped, that, when the data does appear, it will be of a kind to at once allow an opinion to be formed on the value of the *principle* as well as of the particular machine tested.

ELECTRICAL WELDING. — Among the various uses to which electricity has been applied, the welding of metals is one of the latest. Two distinct processes are now in use, — that of Prof. Elihu Thomson, and that of M. Bernados. In Thomson's method a very heavy current is sent between the metals to be joined (which are held firmly against one another), heating the junction until it is to a welding heat. The junction is, of course, the point of greatest resistance, and therefore the heat is mainly concentrated there. The currents are obtained from the secondary of an induction-coil supplied with alternating currents: this secondary is of very low resistance, and is secured to the pieces to be welded by massive clamps. It will be seen that this method is especially applicable to the welding of tubes, rods, wires, etc. The process of M. Bernados is very different. In it the heat of the electric arc is used, the junction to be welded being made one of the poles. Current is obtained from accumulators especially built to resist the ill effects of a heavy discharge rate, and the arc is directed to the proper place by a rod of carbon held in the hand in a suitable holder. The method of operation consists in placing the pieces to be welded on a heavy iron slab, which serves the double purpose of supporting and carrying the current to the plate, meeting the edges of the pieces, then putting the scraps of iron (if iron is to be welded) on the junction, and melting the whole together. For welding steel or wrought iron, a mixture of sand and lime is used as a flux; when copper is one of the metals used, borax is employed. Mr. Ryves, who has investigated the process, and has lately read a paper upon it before the Society of Telegraph Engineers and Electricians, states that in nearly every case the metal was badly burnt and spoiled by the excessive heat. M. Bernados has also lately made a number of experiments on the working of various metals and the production of alloys in electrical furnaces. As far as welding goes, it is very probable that the electric arc can be regulated to give the required heat without burning the metal. Of the two welding processes, that of Professor Thomson is surer and more easily controlled; that of M. Bernados is more widely applicable.

DIFFERENCE OF POTENTIAL BETWEEN METALS IN SOLUTIONS OF DIFFERENT STRENGTHS. — The following table is not without interest as showing the variation in the electro-motive force of a cell, which might occur when the solution changed in strength from evaporation or other causes. It is unfortunate that potassium cyanide was chosen as the electrolyte, instead of some more commonly used substance. One curious result will be noticed: zinc and copper have a potential difference from a carbon electrode which is at first considerable; but, as the strength of the solution increases, the two substances get nearer together in the table. Carbon was invariably used as the positive element. The differences of potential are in volts.

Strength	.006	.025	.25	.5	1.	2.	5.16
Zinc	.925	1.130	1 350	1.395	1.450	1.520	1.615
Copper	.250	.390	1.215	1.270	1.295	1.425	1.535
Brass	.290	.580	1.130	1.210	1.295	1.400	1.460
Platinoid	.435	.535	.825	.900	.945	1.030	1.185
German silver	.360	.500	.860	.920	.910	1.050	1.180
Silver	—	.390	.655	.695	.760	.845	.970
Lead	.460	.440	.590	.585	.610	.640	.700
Iron	.230	.300	.539	.450	.430	.470	.455

EXPANSION GALVANOMETER. — Prof. W. E. Geyer and Mr. W. H. Bristor have invented a new and ingenious galvanometer. In thermostats and in the balance-wheels of chronometers the difference in the rate of expansion of two metals is taken advantage of to cause a movement, which in the one case closes or opens an electric circuit, in the other conpensates for the linear expansion of the wheel. Two strips of different metals are usually fastened side by side; and, as one of them expands faster than the other, it causes the system to bend one way or the other. As an electric current causes heating, and as the amount of heating is proportional to the square of the current, some such arrangement as the above might be used for measuring current strength. The disadvantage with the ordinary form would be that the instrument would have to be adjusted for every change of temperature. To avoid this, Messrs. Geyer and Bristor use a broad strip and a wire of german silver fastened together; one end fixed, the other attached to a registering arrangement. The current passes through these strips in series. Now, while for ordinary changes of temperature both the strip and the wire expand alike, yet, when a current is sent through them, the wire, having the smaller section and less radiating surface, heats the faster, and its greater expansion deflects the needle. By a suitable gearing the deflections are made directly proportional to the currents. This instrument can measure both alternating and direct currents. It is simple, and should be unaffected by the presence of magnets.

THE WATER-JET TELEPHONE-TRANSMITTER. — This transmitter has been recently exhibited in England, where it has attracted attention, both by its novelty, and its excellent performance as a long-distance transmitter. The following is an abstract from a lecture recently delivered by Mr. G. W. de Tunzeemann: "The jet-transmitter consists of a small jet of water, acidulated to render it a conductor, falling upon two electrodes, consisting respectively of a platinum wire, and a platinum ring concentric with the wire, and separated from it by a ring of glass or ebonite. The connection between the electrodes is formed by the nappe of the jet; and, when the jet is thrown into vibration by the sound of the voice, the variation of resistance between the electrodes causes it to act as a transmitter of great delicacy. This delicacy is so great that the voice of a person speaking in an ordinary tone at a distance of fifteen or twenty feet from the instrument is reproduced in a distant telephone with the most perfect distinctness."

BOOK-REVIEWS.

Missouri, a Bone of Contention. (American Commonwealths.) By LUCIEN CARR. New York, Houghton, Mifflin, & Co. 16°.

THE history of Missouri, like that of the other Western States, is necessarily lacking in the interest that attaches to that of the older parts of the Union; but it has elements of interest belonging to itself, which the author of this work has skilfully availed himself of. He begins his narrative with the earliest French explorations and settlements in the basin of the Mississippi, and traces the history of the region west of that river, then known as Louisiana, down to the time of its annexation to the United States; and the chapters treating of these subjects, though they rather pass the proper limits of a history of Missouri, are among the best in the book.

From the time of the annexation the narrative is confined to Missouri itself; and the author then shows how the fertile spot which had been contended for by France, Spain, and England, became a new 'hone of contention' to the advocates and opponents of slavery. The struggle began with the application of Missouri for admission into the Union as a slave State; and though the difficulty was then thought to have been settled by the well-known Missouri Compromise, yet this proved to be only the beginning instead of the end of the trouble, which could not be removed except by the complete abolition of slavery. Accordingly, the latter portion of Mr. Carr's work is necessarily occupied almost exclusively with the various phases of the slavery contest and the civil war, so far as these affected Missouri, which they did in a marked degree. In his account of this great struggle we are sorry to find Mr. Carr's sympathies so strongly on the side of the South. He does not defend slavery; indeed, he shows a decided dislike of it. But, like most of the Southerners and of their Northern sympathizers, he fails to comprehend the moral significance of the anti-slavery movement and the moral earnestness of those engaged in it. In describing the secnes and incidents of the war, however, he shows himself a firm friend of the Union; and in his last chapter he relates with evident pleasure the action of Missouri, alone of all the Southern States, in abolishing slavery within her borders. The stirring themes of war and political struggle fill so large a portion of the later chapters of the book, that we do not get from them so full an account of the social condition of the people in the generation just passed as might have been wished. In some of the earlier chapters, however, the life and industry of the people are described more fully; and careful notice is taken of the financial disturbances that occurred at various times, and of the legislation of the State in regard to banks and railroads and the still more important subject of education.

Taken as a whole, the author's choice of topics is excellent; and he has been particularly successful in showing the connection of Missouri's history with that of the neighboring States and of the Union. The style of the work, though somewhat diffuse, like most of the historical writing of the present day, is clear and dignified; and some portions of the story, such as the conquest of New Mexico and the events at the opening of the civil war, are related in a way that is both interesting and impressive. The book will fill a useful place in the series to which it belongs.

Popular Physics. By J. DORMAN STEELE. New York and Chicago, Barnes. 16°.

TO quote from the author's preface, "this work has grown up in the classroom," and all those who have used any of Steele's Fourteen Weeks Series in natural science will know how admirably this series is adapted to use with elementary classes. The author was in the habit of making a memorandum of any explanation which fixed the attention of the learner, and his books were built up on this experimental method. It is not pretended that the treatises are exhaustive, but it is believed that they are such as to interest beginners, and so to place science before them that some at least may be induced to go further.

Shortly before his death, Dr. J. Norman Steele, finding that he was unable longer to perform extra labor, requested Prof. W. LeConte Stevens of the Packer Collegiate Institute, Brooklyn, to revise the text-book in physics, as so many advances had been made since the last edition of the 'Fourteen Weeks in Physics,' published in 1878. Professor Stevens's revision has been so thorough and extensive, that it has seemed desirable to change the name to 'Steele's Popular Physics,' and it is under this title that the well-known book now makes its appearance. The book is intended for use in high schools, and gives enough in each branch of the subject to make clear to high-school pupils such physical phenomena as they see about them. All those who know the reviser will feel confidence in the thoroughness of his work.

Our Native Ferns and Their Allies. By LUCIEN M. UNDERWOOD, Ph.D. 3d ed. New York, Holt. 12°.

THE third edition of this useful book will be welcomed by all fern-lovers, and we predict for it a ready sale. One hundred and fifty-six species of true ferns are described as native to the territory, — sixteen more than were included in the first edition, printed in 1881; while of the related plants, lycopods, *Equisetæ*, *Isoetæ*, etc., sixty-eight species are given. The descriptive portion of the work is preceded by a carefully prepared account of the structure-habits, haunts, geological history, and the relation of *Pteridophyta* to the other sub-kingdoms of plants. This last is especially treated in the chapter on 'The Fern's Place in Nature,' including brief accounts of the several systems of vegetable classification. Professor Underwood gives greatest prominence to what he terms the 'American System,' which, dividing the *Thallophytes* into three sub-kingdoms, founded entirely on the characters of the reproductive organs, completely destroys the natural groups of algæ, lichens, and fungi, and, in the writer's opinion, is not to be commended. This is, however, quite unessential to the general purpose of the book. Older specific names for many of the species are extant, and we regret that Professor Underwood did not take the opportunity of adopting them. In the next edition he may, perhaps, conclude to do so.

The Fundamental Principles of Chemistry. By ROBERT GALLOWAY. London and New York, Longmans, Green, & Co. 12°. $1.75.

IT would probably be difficult to find a better exemplification of the fact that the critical and creative faculties are not invariably associated in the same individual than appears in several recent attempts, on the part of prominent fault-finders with existing models, to produce something better in the way of elementary text-books of science.

The volume before us emphasizes this point once more, and with force. It is an effort to replace the chemical text-books in use in the schools, and for teaching junior students generally, by a production "more in harmony with the laws of thought." The author has "long held that chemical works intended for beginners are unsuitable as educational works; if these books extend only to a few pages, the arrangement and construction is the same as that adopted in Gmelin's great work of *reference* in the science, which extends to eighteen large volumes: the plan is encyclopedic, — excellent for a book of reference, unsuitable for an educational work. In this system the facts are unclassified; the laws, the highest generalizations, are placed apart from the facts; and no plan for teaching the language of the science, which requires to be taught like any other language, is given beyond a few general observations." Twenty years ago these views were announced, and, if we are to judge from the internal evidence of the book, changes of method during the interval which has elapsed have not commended themselves to the author. The work is ostensibly devoted to the "fundamental principles of chemistry;" but examination reveals the fact, that, of three hundred and fifty-six pages, nearly one-half is given up to the exposition of the subjects of molecular attraction, heat, gravitation, the properties of gases, the elastic force of vapors, density, sublimation, precipitation, adhesion, and capillary attraction, which are regarded as the general principles of physics "suitable for the course of pure chemistry given in the after-part of the work." It is without doubt most desirable that the student of chemistry should possess a knowledge of the principles of physics, and, were this part of the work endowed with any particular novelty or merit, the misleading character of the title might be passed by; but the sad fact is, that in the preparatory half of the book we fail to find any thing but the old tale of multitudinous facts and principles, presented in a manner far inferior to the best modern examples, and insufferably dull. Even in the matter of information it is not up with the times. We are told that "the two prevailing opinions with regard to the nature of heat are the *theory of emission* and the theory of *undulation;* the latter of which, it is added, is now generally accepted, but so overburdened with inherited terms of indefinite meaning as to occasion much confusion of mind, and to necessitate the admission to the student seeking exactness, that all who study the subject are impressed with their vagueness and unsatisfactoriness. After this we could hardly be surprised to note that the atomic hypothesis is an invention of the "late Dr. Dalton," who derived some suggestion of it from the ancient philosophers, by which term, we presume, reference is made to the late Lucretius, Leukippos, and others.

The latter half of the book, however, is so much worse, from an educational point of view, that we are inclined, on the whole, to admire the astuteness which led to a change of base and the filling-in of the former half with less unwieldy material, though the proceeding is somewhat suggestive of the tricks of the medical practitioner of tradition, who, failing in the diagnosis and treatment of existing complaints, possessed the art and acuteness to get his patient into fits, in the management of which he considered himself to be an adept. As in most books on elementary chemistry, we find descriptive text, directions for experiment, and problems to be solved; but the scientific method — the careful and logical adjustment of experimental conditions to the end of securing conclusions as definite as possible — is lacking. We are told that the elements combine to form compounds, and the fact is illustrated by the burning of phosphorus in oxygen, and other similar experiments; but not a particle of evidence, beyond mere assertion, is adduced to show that the action is synthetical rather than metathetical or analytical. The union of two elements in more than one proportion is not proved by appeal to the evidence of the balance, to the value of which the author has paid tribute in connection with the elucidation of the principles of its mechanism; but, instead, we are treated to the following: "We have now to inform and demonstrate to the learner that more than one compound can be formed, in many cases, by the union of the same elements. This will at once be rendered easily intelligible to him if we make use of our former comparison. There are different words composed of the same letters: there are, for instance, two different words composed of the letters *t* and *o*, viz., 'to' and 'too;' the same with the letters *b* and *e*, viz., 'be' and 'bee;' and other examples will at once recur to the student. In like manner, for example, there are two compounds of carbon and oxygen: viz., carbon monoxide, the symbol for which is CO; and carbon dioxide, which, for the present, we will represent by the symbol COO. This latter compound, it will be seen from the symbol, contains double the quantity of oxygen the former contains." This is puerile; but the pendulum swings to the other extreme, and the student, not yet informed as to the laws of combining proportions, the qualities or constitution of acids, bases, or salts, is expected to extract an intelligent idea from descriptions like the following, which, if not taken bodily from "Gmelin's great work of reference," might easily have been so derived, so far as form of statement and assumption of previous knowledge are concerned: —

"The bones being freed from organic matter, and in form of ash, are treated with sufficient sulphuric acid to form an acid phosphate: —

$$Ca_3(PO_4)_2 + 2H_2SO_4 = CaH(PO_4)_2 + 2CaSO_4.$$

The solution of the acid phosphate is poured off from the insoluble $CaSO_4$; the solution is evaporated to a sirupy consistence; it is then mixed with a sufficient amount of charcoal, evaporated to dryness, and afterward gradually heated to full redness in an appropriate vessel. Two-thirds of the phosphorus distils over, and is condensed by the water contained in the receiving-vessel. The operation may be regarded as consisting of two stages: 1st, the conversion of the acid phosphate; 2d, the setting-free of the phosphorus: —

(1) $CaH_4(PO_4)_2 = Ca\,2\,PO_3 + 2\,H_2O.$

(2) $3\,(Ca\,2\,PO_3) + 10\,C = P_4 + Ca_3(PO_4)_2 + 10\,CO.$"

These examples are sufficient to show the spirit of the book, which is lacking in those qualities of method which have lately begun to appear in elementary chemical literature, and give promise of the evolution of something more in accord with advanced ideas in matters of education. In our humble judgment, this volume is entirely unsuited to the needs of the modern classroom or laboratory.

A Companion to School Classics. By JAMES GOW. New York, Macmillan. 16°. $1.75.

Chronological Tables. By ARTHUR C. JENNINGS. New York, Macmillan. 12°. $1.25.

THE first of these books treats a variety of subjects that students of the classics need to know about, and which cannot be adequately dealt with in the ordinary commentaries. It is divided into five parts, treating respectively of classical texts, the public economy of the Greeks and Romans, the drama, and philosophy. Mythology and geography are not included, doubtless because there are works enough on these subjects already. The Homeric age also is left untouched, on the ground that it is sufficiently illustrated in Professor Jebb's work, and others devoted to that special theme.

The second and third divisions of the work, which deal with public affairs, are the longest, and give an excellent brief description of the Athenian, Spartan, and Roman constitutions, with accounts of the public assemblies and of the various officers of state and their duties. The military and naval establishments are also described, and there are chapters on finance, on chronology, and on weights and measures. In these parts of his work Mr. Gow has presented a vast amount of information in a small compass; yet it is so well arranged and so clearly stated, that, notwithstanding its condensation, it is read with ease and pleasure. Indeed, we do not know where to look for so good an account of Athenian and Roman public affairs, in a form at once clear, concise, and full enough for ordinary students, as Mr. Gow has here given us.

The other parts of the work are of a more scholastic character, especially the first, which gives a brief history of classical texts. First comes a history of the Greek and Latin alphabets; next a description of the mode of writing and of making books in ancient times, followed by a history of classical manuscripts in the middle ages and after the revival of learning; and then a full account of the means and methods of textual criticism. The chapters devoted to these subjects are necessarily somewhat dry; but the information they contain will be useful not only to young students, but to all persons interested in the history of literature. The accounts of the drama and philosophy are briefer than the other portions of the work, but are sufficient for the ordinary purposes of classical students.

From the analysis here given it will be apparent that Mr. Gow's work is different from the other helps to classical study that are now so abundant; and it contains so much that is excellent, that we hope to see it introduced into the schools of this country. Of course, in a work dealing with so many subjects, and necessarily touching many controverted points, it is difficult to secure unimpeachable accuracy; and we can well believe the author when he says that he has found the preparation of the work extremely difficult. Nevertheless, its accuracy, so far as we have been able to test it, is of a high order; while in style and arrangement it is much superior to most of the works with which it is naturally compared.

Mr. Jennings's work is a synchronistic arrangement of the chief events of ancient history, and will be a useful companion to all students of the ancient world. It is not confined to Greek and Roman affairs, though these necessarily occupy the foremost place, but gives also the dates of the leading events in Jewish, Egyptian, and Assyrian history, and of some specially important occurrences in India and China. The tables are arranged in six columns, dealing respectively with political history; Jewish church history; wars, popular movements, catastrophes; biography and topography; inventions, discoveries, science, art; laws, literature, drama, institutions. The chronology ranges from the received date of the foundation of Rome, 753 B.C., down to the Christian era. In regard to very many facts of ancient history, exactness of date, as the author remarks, is unattainable; and he has thought it best to adhere in the main to the schemes of chronology usually found in dictionaries of dates, and other educational works. The special excellence of the work lies, of course, in its parallel presentation of events in many nations, and in many different departments of human activity; and in this respect it has eminent advantages over most other chronological works.

We should add that both the works here noticed are provided with elaborate indexes, which greatly enhance their usefulness.

Physical and Industrial Training of Criminals. By HAMILTON D. WEY. (Monographs of the Industrial Education Association, Vol. I. No. 3.) New York, Industr. Educ. Assoc.

AMONG the many innovations in penal science introduced at the New York State Reformatory, there is perhaps none with so great an interest to the scientist and the educator as the experiment of reaching the unresponsive intellects of refractory and stupid criminals through their muscles. This experiment, noticed in these columns some time ago, carried with it the proof of its success. It was due to the author of this pamphlet, Dr. H. D. Wey, physician to the reformatory at Elmira. In the present pamphlet Dr. Wey rehearses this experiment, and surrounds it with a valuable analysis of the criminal character, — the only sound basis of true and lasting reform. He here portrays the deviation of the psychophysical organism of the criminal from that of his more fortunate fellowmen, and deduces from it the sound conclusion that the only method of restoring the criminal to a worthy place in the community is to re-organize that fundamental re-action between an individual and his environment that makes crime tempting. For this purpose one must educate the criminal, and that not only in the usual sense of literary instruction, but with the additional meaning of re-forming the habits of his body and mind; and when, in especially dull and sluggish men, it was found that a direct appeal to the will and the intellect was unsatisfactory, the logical step was taken of treating the muscles, the physiological organs of the will: for modern physiology tells us that in muscular exercise we develop not only the muscle, but, more important, the nerve-cell that controls its action; we are building brain and power alike. Such a purely physical training brought the average marks of a dozen most unpromising men for purely intellectual studies from 46 per cent to 71 per cent. The effect is immediate, and, if the treatment is sufficiently prolonged, is lasting.

The second portion of the pamphlet is devoted to the industrial system at Elmira. Idleness is the source of a good share of the world's misery; and every moment of a prisoner's life ought to be systematically occupied. Moreover, the work should be made as interesting as possible, not assume the air of a task imposed as a process of torture. Add to this, that the industrial training must be such as to fit the liberated man to earn his livelihood, and at once (for it is immediately after liberation that the greatest danger exists), and it seems to follow as a necessary deduction that the reformatory workshop must approximate to the real hives of production in the surrounding world. In addition, the educational value of manual training is to be made a special point. This is what the reformatory at Elmira is attempting to do; and the success of the enterprise, after it is properly understood both by the men themselves and by the public, seems beyond question. This monograph, it is hoped, will be the means of extending the sound teachings and practices in vogue at the New York Reformatory.

Negro Myths from the Georgia Coast. By CHARLES C. JONES, Jun. Boston, Houghton, Mifflin, & Co. 12°.

THE title of this book is not quite correct, for the tales told in it are not myths, but fables. Some such stories had already been collected by other writers; but Mr. Jones has found in the swamp region of Georgia and the Carolinas a comparatively unknown field, in which he has gleaned much that is new. The stories are told in the *patois* of the negroes themselves; which seems to us a mistake, as they are not only harder to read, but less interesting, than they would be in correct English. Moreover, many of the linguistic peculiarities are mere mispronunciations, while others are contractions such as we all use in conversation, and only a few are real dialectical characteristics.

The characters in the fables are mostly animals, the rabbit being the favorite, while the wolf and the alligator are frequently introduced. The stories show not a little ingenuity and humor, and some of them are quite entertaining. One of the best is that about the monkey who didn't know what trouble was, and who went to the Devil to find out. The Devil gave him a closed bag, and told him to go out into the midst of a large field near by, and then open the bag, and he would find an answer to his inquiry. The monkey obeyed, and when he had reached the middle of the field opened the bag, when out jumped a bull-dog. The monkey started and ran, and the dog ran after him until they reached a wood, when the monkey succeeded in climbing a tree, but not without the loss of his tail. The dog staid by the tree and watched till he was hungry, and had to go off in search of food. Then the monkey came down and went home to his wife, telling her that he had had enough of trouble. The moral is obvious: never search for trouble, but wait till it comes to you.

Besides the fables, a few other stories are given, the most important being those relating to the negro belief in spirits, fetiches, and charms. These show, what was already known from other sources, that the Southern negroes are hardly less superstitious in some respects than their African ancestors, and that a great deal will have to be done to raise them to the level of civilization.

Lessons in Geometry, for the Use of Beginners. By G. A. HILL, A.M. Boston, Ginn. 12°.

THIS admirable little book is a grammar-school geometry, and as such lies midway between the courses in geometrical drawing followed in some of our city schools, and a course in ordinary demonstrative geometry. It is intended to follow the study of arithmetic. The method followed is in great part that of question and answer. Each new idea is put in very simple language. Definitions are carefully explained, and in many cases illustrated by cuts. In short, every difficulty which the pupil is likely to meet with seems to have been anticipated. The few demonstrations that are given are all based on the method of equal triangles. The most important feature of the book is the large number of exercises. Of these, those which involve the metric system are separated from the others, and can be omitted if desired. A cheap case of drawing-instruments accompanies the book. The book is adapted to the needs of every grammar-school in the country, and could with advantage be used in all of them. For practical knowledge gained, few branches would better repay the time devoted to the study of this book. It is printed in the elegant style in which the publishers are accustomed to issue their works. G. W. SAWIN.

Trigonometry for Beginners. By Rev. J. B. LOCK, M.A. New York, Macmillan, 1886. 16°. 60 cents.

THIS little book is an abridgment of the 'Elementary Trigonometry' by the same author. Very little knowledge of geometry is assumed. Some points, such as the circular measure of an angle, the fact that the ratios depend only on the magnitude of the angle, and the explanation of tables, are much better put than it is customary to find them. The book also contains a very large number (about seven hundred and fifty) of exercises, which are much better chosen than those in the trigonometries in common use, those in formula-work being particularly good. These exercises, together with the low price of the book, make it especially valuable as a secondary treatise for teachers who are using another textbook. The book is too small for the amount it contains, and as a consequence its pages are much crowded.

Geometry in Space. By R. C. J. NIXON, M.A. Oxford, Clarendon Pr. 12°. (New York, Macmillan, 90 cents.)

THIS is a brief treatment of solid geometry, modelled on that of Euclid. A short introduction on perspective is prefixed, however, and some modern ideas are introduced, such as anharmonic ratio, similitude, inversion, and poles and polars, these subjects being very briefly treated. The number of exercises is also large. A chapter on the geometrical theory of perspective is appended. The book is well printed, but would be much improved if the type were larger.

NOTES AND NEWS.

THE third part of the annual report of the Geological Survey of Pennsylvania has just been issued. It treats of the operations in the anthracite-coal region, and is accompanied by an atlas, embracing the coal-region, and based upon the triangulation of the United

States Coast Survey. The report contains, besides the results of geological surveys, valuable statistics of the production and shipment of anthracite coal for 1885 and 1886. At the same time have been issued the atlas-sheets embracing Bucks and Montgomery Counties.

— Ch. Montigny was led by an occasional observation to the study of the scintillations of stars and their relations to atmospheric disturbances. On Dec. 7, 1886, during his observations at Brussels, that the scintillations of the stars suddenly increased, although the meteorological instruments showed no change whatever. A few hours later, however, the barometer began to sink, and a gale arose which lasted for two days. This led the observer to the conclusion that the high strata of the atmosphere were disturbed hours before the instruments were in any way affected. A thorough investigation of observations showed that this was of frequent occurrence, and that the scintillations also continued after the storm had passed. Besides this, they were the stronger the fiercer the storms raged, and the nearer the minimum passed the place of observation.

— The 'Second Annual Report of the Meteorological Institute of Roumania for the Year 1886' is a valuable contribution to our knowledge of the climate of south-eastern Europe. It contains only the results of observations made at Bucharest, although a considerable number of stations of the second order have collected meteorological data, the appropriations being insufficient for their publication. The director of the institute, Prof. Stefan C. Hepitos, well deserves the thanks of meteorologists for the valuable work he has done, the amount of which is astonishing, considering that all has been done with an annual appropriation of less than $2,400. He sets forth an interesting plan of increasing the number of stations and of a thorough study of the climatic elements of Roumania, which, if carried out, would give us the much-desired data on the meteorology of that region.

— The Prince of Monaco has published several preliminary papers on the results of the cruises of his sailing yacht 'L'Hirondelle.' In 1885 her course was from Lorient to Cape Finisterre and the Azores, whence an excursion was made north-westward as far as 44° north latitude. Having returned to the Azores, she sailed north-north-west as far as 50° north latitude, and then returned to Lorient. In 1886 the prince sailed westward from Cape Finisterre until he reached the twentieth degree west from Paris, which he followed to 50° north latitude. The special object of this cruise being to ascertain the connection of the currents of the Bay of Biscay with those of the Atlantic, a great number of floats were immersed on this route, part of which were found again, thus furnishing valuable material regarding the currents of the North Atlantic. The last cruise was even more extended than the first ones. Starting from the Azores, the prince followed a straight line to Newfoundland, thus crossing the Gulf Stream drift. On this line 931 floats were set adrift. At the same time, soundings, bathythermometrical readings, and dredgings were made. Attention was paid to the subject of fisheries, particularly to that of the sardine, which was formerly so abundant on the French coasts, while it has now almost disappeared.

— Prof. F. W. Clark of the National Museum will make a unique collection of mineral species for exhibition at the Cincinnati Exposition. A portion of the twenty-five thousand dollars appropriated by Congress to enable the Government of the United States to participate in that exposition has been placed at Professor Clark's disposition, and he will supplement the specimens he will select from the museum collection with others obtained especially for this occasion. The collection will be of great scientific value.

— *Petermann's Mitteilungen* for May publishes a full account of Captain van Gèle's exploration of the Obangi, accompanied by a map which has been constructed by B. Hassenstein, who reduced Junker's observations in the country adjoining the upper Welle. He calls attention to the important fact that Junker learned of the existence of a chief called Bangusso four days' journey west from Singio. Van Gèle discovered a northern tributary of the Welle, which was called by the natives Bangasso as coming from Bangasso: therefore it is probable that Van Gèle's Bangasso is the lower course of Junker's Mbomo, on the banks of which Bangusso's village is situated. In this case the Kutu would prove to be a tributary of the Mbomo. Since the great discoveries in the basin of the Kassai no expedition has helped more to make clear the hydrography of Central Africa than Van Gèle's, the limits of the Kongo watershed being now pretty well known.

— The Linnæan Society held its centenary celebration May 24, according to *Nature* of that date. The following eulogia were pronounced: on Linnæus, by Prof. Thöre Fries, the present occupant of the chair of botany at Upsala; on Robert Brown, by Sir Joseph Hooker; on Charles Darwin, by Professor Flower; on George Bentham, by Mr. W. T. Thiselton Dyer. The Linnæan gold medal, instituted by the society on the occasion of its centenary, was presented to Sir Joseph Hooker (botanist) and Sir Richard Owen (zoölogist). In subsequent years the presentation will be alternately to a botanist and zoölogist.

— 'Popular Physics,' by J. Dorman Steele, Ph.D. (A. S. Barnes & Co., publishers, New York), forms the third of a new series upon the sciences. Many of the features of its parent book, 'Fourteen Weeks in Physics,' will serve to identify this new work. —— T. Fisher Unwin, 26 Paternoster Square, London, announces a second edition, revised and rewritten on the basis of the first edition by Edward Newman, of 'Birdsnesting and Bird-skinning,'— a description of the nests and eggs of birds which breed in Britain; with directions for their collection and preservation, a chapter on bird-skinning, and description and woodcuts of the instruments necessary to the collector, — by Miller Christy. —— Messrs. James W. Queen & Co., Philadelphia, have just issued a new and very complete edition of their catalogue of electrical testing apparatus. This covers nearly every form of apparatus called for in a well-equipped electrical laboratory.

— In the June *Andover Review* Dr. Bemis continues his papers on immigration, pointing out in the present number the distribution of our immigrants. The experiment at Harvard in solving the problem of the relation of religion in its outward form to university life, is clearly stated by Rev. D. N. Beach. Professor James of the University of Pennsylvania gives an account of the requirements for the degree of Ph.D. in German universities. —— *The American Garden* for June is a special rose number. —— The approaching 'heated term' renders an article on 'Summer Indigestion and Diarrhœa' in the current number of *Babyhood* seasonable.

— It is not often that a part of Edwards's superb 'Butterflies of North America' appears with so much interesting matter in it as is found in the fifth number, just issued. A rare form of Californian *Melitæa* is figured, — of which all efforts to obtain the early stages have so far been unsuccessful, — two species of *Erebia* from the Rocky Mountains, and our eastern *Portlandia*. The plate of the latter is crowded with figures of early stages in most exquisite delineation. Although figured long ago by Abbot, his drawings, published by Boisduval & LeConte, were among the worst he ever made, so as to be quite misleading; while Mr. Edwards figures also the egg and every stage of the caterpillar, — a thing the more difficult to do, as it hibernates in the middle of its larval life. The text gives a complete history of this interesting and excessively local species, the habits of which are described in very different terms by different observers. But the most interesting of all is the plate of *Erebia*, which figures, as we have said, two species, giving for one of them the egg and earliest stage of the caterpillar; the latter never before figured or described for this genus, although thirty or forty species are known in Europe. That it should finally be made known by a naturalist in Eastern America, where it is unknown, is a curious commentary on the zeal of our transatlantic brethren. The species has been taken only by one collector, and only at a height of from twelve thousand to fourteen thousand feet on the front range of the Rocky Mountains in Colorado, where the ground is covered by broken black rocks, above which the butterfly, which is of a deep black color, rarely rises far, and upon which when alighted it can scarcely be detected. When we learn from the cover that the expense of the preceding number was only partly covered by a grant from the Elizabeth Thompson science fund (the first help the author has had), we can gauge to some extent our past pecuniary indebtedness to the indefatigable author, who steadily issues these incomparable iconographs.

— W. William Topley, general secretary of the committee on organization of the coming (fourth) session of the International Geological Congress in London, desires that all scientific societies, libraries, institutions of learning, and individuals having any interest in the publications relating to the purpose of the congress, and the volume of its Proceedings containing the reports, papers, maps, etc., should secure these publications at the trifling cost of the membership fee to the congress, of ten shillings, or about two dollars and a half. For every such sum sent to him at the museum, 28 Jermyn Street, London, the sender, whether an institution or an individual, will receive all the documents which it or he would receive were the sender actually present as a member of the congress. Some of these publications, not to speak of the volume, will be of great value, and cannot be otherwise procured. Address William Topley, Esq., general secretary International Congress of Geologists, Museum, 28 Jermyn Street, London. The volumes of previous sessions of the congress alone are now difficult to procure at twice this cost, or more.

— The Royal Society of Canada has, since its establishment, done much to promote the interests of science in the Dominion. In his annual address delivered at the recent meeting which was held in Ottawa May 22–24, the president, Dr. Lawson of Halifax, reviewed the work of the society during the past year. The Transactions of the society for 1887 fill a large volume; although, of seventy papers which were presented, only forty were printed, the rest being kept back by the authors for the purpose of being perfected by additional work. He called attention to the preponderance of papers in the geological and biological section over those in the sections of English and French literature, which had increased more and more, showing the greater interest taken in science as compared to history and philology. In the course of his address he urged the granting of aid from the British Parliament for the purpose of making observations of tides and currents. This would not only be of substantial value to the shipping community, but would be a benefit to the country at large. A committee was appointed to co-operate with the British Association in pressing the necessity of such observations upon the Parliament, but so far no practical result has followed. A scientific federation of the empire, which was being agitated under the auspices of the Royal Society in London, also engaged attention, and was considered a matter of the greatest importance, in view of the aid that could be given to a geological survey of the Dominion. A committee appointed to inquire into the matter reported favorably on the subject, and the council of the Royal Society was given permission to act upon this report. On Friday the sections presented their reports. The section for French literature stated that they had decided to establish a fund of ten thousand dollars for a prize at the French Academy, to be called 'The New France Prize;' the interest, three hundred dollars, to be given in annual prizes to the author of the best work in French, to be published in France or Canada, on a subject to be determined by the academy. Sanford Fleming was elected president for the ensuing year.

LETTERS TO THE EDITOR.

**** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

Twenty copies of the number containing his communication will be furnished free to any correspondent on request.

The editor will be glad to publish any queries consonant with the character of the journal.

Genealogy of Ideas.

IN the study of the genealogy of ideas there is a series of questions which have sprung up as corollaries to the problems involved in similarities. In Col. Lane Fox's exhibition of weapons, structure is the fundamental concept. All weapons of the same plan of structure are in the same row. The second concept is complexity of form and structure, and the pieces are arranged in their row according to their elaboration, the worst on the left. No good anthropologist would argue from this order that the row represented a genealogical line, in which each one at the right is child of the one immediately on its left. The only safe conclusion is, that the history of invention has travelled somewhat in this manner.

The corollary to all this is, that arranging the arts of different races in such a developmental series gives us a fair means of gauging these races in the scale of excellence and advancement. If people A are found in the whole group of series to stand on the left of people B, then they are an inferior people. If, on the contrary, we make ourselves A, and, comparing our inventions and institutions of all kinds with those of B, we discover that we stand on the right rather than on the left, there should be no hesitation in rating ourselves accordingly.

The next corollary is, that we cannot neglect historical studies. Genealogies are to be traced historically. The Russian banjo did not descend from the Aleut banjo, but really descended to it, and shows that which occurs again and again in arts and institutions, the degradation of invention.

O. T. MASON.

Washington, May 30.

New York Schools.

AFTER investigating the English musical system known as the Tonic-Sol-Fa, and finding its great superiority to the staff method, which I had taught for twenty years, I naturally sought to interest music-teachers and educational people in the system. For this purpose I had several interviews with Superintendent Jasper. My reception from him was about as cordial as if I had been the vendor of a quack nostrum. At last he settled the question by saying very emphatically, "Mr. Seward, I am *opposed* to the Tonic-Sol-Fa System!" As he knew nothing about it, and refused to give any attention to the overwhelming testimony of English and American teachers, in favor of the system, I was led to ask myself what progress could possibly be made by the New York schools in any direction under the control of such a superintendent.

THEODORE F. SEWARD.

East Orange, N.J., May 30.

YOUR editorial note in the issue of your paper for May 25, discussing the system employed in the New York public schools and the relation of the present superintendent to it, ought to have been read by every teacher in New York City. The truth is, that barnacles by the score are nourished and fattened by the present state of affairs, and all their powerful influence is enlisted against any change. The publishers and the politicians run the schools at present, and neither publishers nor politicians hesitate to use corrupt and debasing means to attain their ends. One man who knows as well as any one else — if not better than any one else — how thoroughly rotten and inefficient the present administration is, takes the stand, and calmly testifies that it is scholastically perfect and sound! Why? Because his text-books are used, and he fears their being displaced by others if a new *régime* is inaugurated, or if he offends the "powers that be" at present.

New York's citizens do not understand the present crisis, or there would be an agitation which would put those in favor of high license, clean streets, or home rule into a dismal shade. The minds and manners of nearly two hundred thousand children are involved. Can nothing be done?

A PROFESSIONAL OBSERVER.

New York, June 1.

Answers.

32. HUMAN BEINGS AS PACK-ANIMALS. — Referring to my friend Professor Mason's query No. 32, I beg to refer him to Darwin's 'Voyage of the Beagle,' Chapter XVI., pp. 340 and 341, for a capital account of the 'duty' of men used as beasts of burden. The passage is too long to quote here, but any one interested can easily turn to it. The Chinese porters of San Francisco would furnish him with examples of high 'duty' also. I regret that I cannot give numerical estimates. I can only say that loads which I have vainly tried to lift from the ground were carried by undersized Chinese at quite a rapid walk. In many cases such loads are carried up and down hills too steep to drive upon.

EDWARD S. HOLDEN.

San José, Cal., May 28.

BOOK-NOTES.

—'The Building of a Railway'—the first of a series of railroad articles to begin in the June number of *Scribner's Magazine*—is said to be a remarkably succinct and entertaining description of the whole process of railway construction, from the engineer's preliminary survey to the final laying of the track.

—Messrs. Ticknor & Co. announce for immediate issue revised editions of 1888, of their guide-books of New England, White Mountains, and the Maritime Provinces. The June volumes of Ticknor's Paper Series will be as follows: 'Sons and Daughters,' by the author of 'The Story of Margaret Kent' and 'Queen Money;' and 'Agnes Surriage,' by Edwin Lassetter Bynner.

Calendar of Societies.

Biological Society, Washington.

May 19.—F. W. True, The Hawaiian Bat; William T. Hornaday, Man-Eating Crocodiles; C. Hart Merriam, A Revision of the *Dipodidæ*; F. A. Lucas, The Affinities of *Chamæa*.

Anthropological Society, Washington.

May 15.—Francis La Flesche, Funeral Customs of the Omahas; Garrick Mallery, Algonkin Glyphs on Bark and Stone.

Philosophical Society, Washington.

May 26.—Robert T. Edes, The Sphygmograph; H. A. Hazen, The Recent Mount Vernon, Ill., Tornado; Merwin-Marie Snell, Observations on Certain Hypnotic Experiments of the Comte de Maricourt; E. D. Cope, The Relation of Consciousness to Animal Motion.

Natural Science Association, Staten Island.

May 12.—William T. Davis, Entomological Notes; Samuel Henshaw, Discovery of a Wild Rabbit's Nest in a Small Pile of Tobacco-Stems.

American Academy of Arts and Sciences, Boston.

May 29—William Everett, Biographical Notice of the Late Hugh A. J. Munro; Arthur Searle, Biographical Notice of the Late Alvan Clark.

Engineers' Club, St. Louis.

May 16.—Charles F. White, The Failure of a Firmenich Boiler; Louis Stockett, A Well Ventilated Mine.

University Science Club, Topeka, Kan.

May 25.—F. H. Snow, The Discovery and Significance of Stipules upon Certain Fossil Leaves of the Dakota; F. O. Marvin, Note on Magnetic Variation in Kansas; L. E. Sayre, Isolation of Alkaloids; The Rosin Weed; V. L. Kellogg, A List of Birds of Estes Park, Colorado; Notes on the Geology of Lyon County, Kan.; Bird-Migration in Kansas; E. H. S. Bailey, Relation between Acid Taste and Strength of Acids; W. S. Franklin, An Extension of Fourrier's Theorem; A Soap-Bubble Electrometer; A Recording Chronograph; Miss Gertrude Crotty, Dissection of the Iliac Artery; E. Miller, Methods in Analytical Geometry; L. I. Blake and E. F. Stimpson, Resistance of Defective Joints cut from the Lawrence Electric Light Circuits; L. L. Dyche, Notes on Mounting Mammals; H. L. Raymond, Commercial Sirup Iodide of Iron; E. C. Murphy, Position of Moving Load which produces Maximum in Bending Beams and Arch Ribs; C. E. Springer, Experiment on Failure of Retaining Walls; W. S. Franklin and V. L. Kellogg, The Perception of Time; The Psychology of Matching Pennies.

Publications received at Editor's Office, May 14-26.

ANDERSON, J. W. Medical Nursing. 3d ed. Glasgow, Maclehose & Sons. 224 p. 16°. $1

BIBLIOGRAPHER, The, and Reference List. Vol. 1. No. 1. May, 1888. *m.* Buffalo, N.Y., Moulton, Wenborne & Co. 30 p. 8°. $2 per year.

CECCHI, A. Fünf Jahre in Ostafrika. Leipzig, Brockhaus. 541 p. 8°. (New York, Stechert, $5 50.)

DRYER, C. R. Science in Secondary Schools. A Prize Essay. Fort Wayne, Ind., G. A. Bacon. 14 p. 8°.

GOODE, G. B. American Fishes. New York, Standard Book Co. 496 p. 8°.

NIXON, R. C. J., *ed.* Geometry in Space. Oxford, Clarendon Pr. 101 p. 12°. (New York, Macmillan, 90 cents.)

ST. BRIS, T. de Discovery of the Origin of the Name of America. New York, Amer. News Co. 140 p. 8°. 50 cents

SOCIETA degli Alpinisti Tridentini, XIII Annuario. Anno Sociale 1886-87. Rovereto, Ditta V. Sottochiesa, Pr. 534 p. 8°.

STIELER'S Hand-Atlas. Lief. i. Gotha, Perthes. f°.

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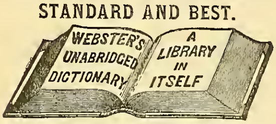

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SCIENCE

FRIDAY, JUNE 15, 1888.

THE LAST REPORT of the statistician of the Agricultural Department presents some interesting data for the students of economics in that portion of it which deals with farm-labor and its wages. Curiously enough, the result of the May, 1888, investigation of wages of farm-labor is almost identical with that of three years ago. The changes are very slight, though local differences occur, the averages of the geographical sections or groups of States being changed very little. The average rate per month, where the laborer boards himself, is a few cents lower in the Middle and Western States and in California, and a very little higher in the South and in New England. The highest rates obtained in 1866 in the Northern and Western States. In California and in the South there was a positive advance between that date and 1869. The investigation of 1875, a year or two after the monetary crisis appeared, showed decline in each section, which continued for several years, culminating in 1879, the date of lowest prices of all American farm-products. The decline from 1866 to 1879 amounted to 39 per cent in the Eastern States, 35 in the Middle, 30 in the Western States, and 17 in the Southern States. In California the rate of averages was well sustained, rising at first, but standing in 1879 higher than in 1866.

By a carefully constructed diagram Mr. Dodge shows the course of prices for more than twenty years, and the diagram is a forcible picture of the fearful depression caused by the six years of panic, from which a slow recovery began in 1879. The sharp decline from 1886, except in California, where the highest point after the war is noted in 1869, is a fall from an era of inflation, in which speculative values were all the higher from being stated in a depreciated currency. The present values appear to be on a more natural and stable basis. The rise was coincident with the return to specie payments, and the natural level was reached by a bound as soon as the pressure which depressed was removed. It is curious to note, further, that, at the lowest ebb of wages, rates were higher in the West than in the Middle States, and slightly above the lowest point reached in the Eastern States, because the soil was still cultivated, and crops were grown in their usual quantity, while much of the manufacturing industry was suspended. This Western line of wages would not have dipped so low but for the immigration to the West of Eastern operatives and artisans out of work, seeking employment and future homes.

There is a sufficiency of farm-labor in this country, as a whole, with a comparatively even balance between the geographical divisions. There are localities in perhaps every State where scarcity exists, and others having a superabundance. There is in some places a scarcity of agricultural labor caused by demand at higher wages for labor in some specific local industry. There is reported now, as always heretofore, a tendency to exercise distinctive preferences, and encourage peculiar aptitudes, for professions and avocations outside of agriculture, generally leading away from the country to the town or city. A temporary disturbance of the relation between demand and supply is found in some localities as a result of a somewhat rapid change in the character of the rural industries pursued. Where general farming has been partly replaced by an extension of pastoral industry, the effect has been to reduce the demand for labor; but in other cases there is a notable increase in gardening and fruit-growing, which occasion a large increase in the labor required for the cultivation of a given area. The continued development of truck-farming, near many of the navigable waters and some of the railroad-lines of the South, affords a conspicuous example of the latter class of changes.

A considerable number of reports from the more Atlantic coast States, and from some farther West, mention the migration of laborers as a cause of a noticeable reduction in the supply of labor. Usually the movement is simply a part of the general westward drift of population, but there are some movements of a more limited and special character. In Mississippi, for example, the reports from certain counties mention the departure of many colored laborers to the richer lands of the Mississippi bottoms or of the Yazoo delta, and a similar movement from a thin upland soil to river-bottom lands is also mentioned by some correspondents in Louisiana and Arkansas. Some reports from Virginia and North Carolina mention the departure of many colored people for the North. Others from the same and other States refer to a movement southward. Some Alabama reports mention a movement of colored laborers to settle on public land in that State as homesteaders. One North Carolina report, that from Cabarrus County, states that forty colored men had left for California, but the labor-supply in the neighborhood from which they had gone was still sufficient. In some localities, however, a considerable deficiency is reported as a result of such migrations.

THE CONTEST in the New York City Board of Education has resulted in the re-election of Mr. Jasper as superintendent by a vote of twelve to nine; and the political ring whose servant he is, is jubilant. It is safe to say, however, that the triumph is but a temporary one: for public opinion is arousing, and a public education society has been formed for the purpose of carrying on the agitation. The leading educators of the city, representative clergymen and lawyers, and not a few of the would-be progressive public-school teachers, met on Saturday last, and laid the foundations for the new society. It will, if we understand aright, take up the task of educating public opinion, and possibly will demand the appointment of a commission to investigate the schools and report a plan or plans for their improvement. This would be an excellent step, more especially as the present mayor enjoys the fullest confidence of the community, and could be safely trusted to appoint a commission that would do its work thoroughly and well. An attempt should also be made to displace the ringsters whose terms expire this year with better men. Four of the seven whose terms expire in December should on no account be re-appointed. The importance of this is well understood, and already representative citizens, like Dr. Mary Putnam Jacobi and Col. R. T. Auchmuty, are suggested for the vacancies.

The Springfield, Mass., *Republican*, in commenting on the condition of affairs, says that "the re-election of John Jasper as superintendent of the public schools of New York was a foregone conclusion. The Board of Education was as much on trial as the superintendent himself. The board exercises many of the prerogatives which in other cities belong to the superintendent, and it could not be expected that it would pass a vote morally condemning its own acts. In the next place, the opposition, or, more properly speaking, the true friends of education in New York, began their attack by first selecting a candidate whose reputation, experience, and force of character were not equal to the tremendous work of reforming the present vicious system of instruction. The large results of the investigation of Mr. Jasper's records will appear next year, when he will be confronted by a rival candidate as well as his own record. The public has now been informed of the sad situation, and will be prepared for serious work when the next two years close and another election of superintendent takes place. When Mr. Kiddle withdrew, and Mr. Jasper took the New York schools in hand, the change was noticed at once. The teachers were all put in the position of wheels contributing to a nicety to the general movement, and the product was a machine-made pupil. The perfect examination was very much on a par with Showman Forepaugh's trick-elephant. If one teacher undertook to feed the starved minds of the little ones, then there was trouble with the machine, and the teacher was subdued." Every word of this is true, and is in full accord with the position that *Science* has taken in this important matter. If the Public Education Society does its full duty, the situation will be materially altered before another election takes place.

The London publishers and printers are getting more and more excited over the provision of the Chace international copyright bill, which requires a foreign book copyrighted in this country to be printed from types set up in the United States. The printing and allied trades section of the London Chamber of Commerce has sent a resolution to the Chamber of Commerce, asking the government to obtain by diplomatic means the withdrawal of the objectionable provision, and, if this is not done, demanding that a similar law be passed in England. What the English publishers and printers desire is an opportunity to make all books written or compiled in Great Britain and sold in the American markets. That is something that the Congress of the United States will never agree to, if the passage of an international copyright act is postponed a quarter of a century. England may prevent books printed in America from being sold in Great Britain, but will never succeed in dictating in what shape a law shall be passed by the Congress of the United States until the former raises a generation of abler diplomatists than she has lately sent abroad.

An item published in the Washington papers last Saturday, entitled 'The Army Ahead,' in which it is represented that competitive tests of the 'indications' work of the Signal Office, to determine the relative merits of military and civilian officers in the performance of this work, had been made, is likely to mislead any one who has not read the description of the present condition of affairs in the Signal Office, published in the last issue of *Science*. The predictions for February were made by Lieutenant Dunwoody, and those for March by Prof. Cleveland Abbe. The percentages of verifications for each month have been computed by Professor Marvin, who found the record as follows: Professor Abbe, indications 75.42 per cent, storm-signals 62.50 per cent, cold-wave signals 53.99 per cent; Lieutenant Dunwoody, indications 80.55 per cent, storm-signals 89.29 per cent, cold-wave signals 86.11 per cent. It should be remembered, that years ago, when the weather reports became most popular and there were nothing but compliments for its predictions, Professor Abbe, then in thorough practice, prepared the indications for a long time. Of late he has been engaged in an entirely different line of scientific work, and it was not to be expected that he would be as successful in preparing indications as an officer who had lately been engaged in that service. General Greely's purpose in putting Professor Abbe upon this duty at all was to train civilians for it in case Congress, as seemed more than probable, should transfer the weather bureau to a civil department.

THE CRENITIC HYPOTHESIS AND MOUNTAIN-BUILDING.

The facts derived from the study of metamorphic rocks and volcanic phenomena make it evident that there are two types of motion which take place in the deeper-buried materials of the earth's crust. One of these classes of movements occurs when volcanic ejecta creep horizontally towards the vent, or when the materials which afford the support of mountain-arches undergo massive movements towards the base of such folds in the rocks. In these cases of horizontal movements we have translations of extensive bodies of matter for considerable distances. The other class of movements taking place in the crust are in a vertical direction. They are brought up in part by the action of water, and in part by the action of igneous forces. The operation of these agents leads to a very extensive transfer of material in a vertical path, from the deeper-buried to the more superficial strata. I propose in the following pages to consider the general effect of this upward movement of matter upon mountain-building.

The simple inspection of most mountain-built districts will show the observer that there has been a very extensive movement of materials from lower to higher levels in the crust in such areas. Taking a considerable surface of mountainous country, where by chance the bed-rocks are exposed to view, we almost always find in such regions numerous veins and dikes. Thus, in the anticlinal districts of New England, especially where those portions of the surface are exposed along the seashore, we are often able to ascertain, that, on the path traversed by a straight line a mile in length, the addition to the material in the more superficial rocks has been sufficient to produce a considerable extension of their area. In some sections having this length, I have been able to prove that the increase in the horizontal section, due to the introduction of the materials derived from below, amounts to as much as from ten to twenty per cent of the original area; or, in other words, on a line a mile in length, the dikes and veins occupy from one-tenth to one-fifth of the distance. Besides the distinct intrusions of matter in the form of dikes and veins, there have in many instances been large contributions to the more elevated parts of the crust through the interstitial contributions of crystalline material. Thus in some of our highly metamorphosed rocks, where the materials have assumed the crystalline structure, a progressive growth of the hornblendic and other aggregations has been observed; so that, besides the contributions of matter which we may reckon from a study of dikes and veins, there is often a large but incomputable element of crystalline growth, serving to extend the rocks, which is not readily to be taken into account.

The immediate causes of this transfer of material from the deeper-lying to the more superficial parts of the earth's crust are now tolerably well known. In large measure it is due to the peculiar effect of temperature upon the water which was enclosed in the sedimentary rocks at the time of their formation, or which may have penetrated into them from the surface. The process of burial beneath sedimentary formed accumulations acts in all cases to lift the temperature of all the rocks which are subjected to such covering. Where these rocks contain the waters of deposition, they are likely in time to be brought to a high degree of heat. The temperature to which they attain, and the pressure to which they are subjected, enable them to dissolve a large share of the materials with which they come in contact. Moving upward in the channels which may be opened by chance riftings of the superimposed strata, these waters, deprived of their power to retain the materials in solution by the loss of temperature in their upward journey, and the relinquishment of pressure which comes about at the same time, lay down deposits in the upper portions of the crust. In a similar manner the descending pluvial waters obtain in the deeper parts of the crust a store of dissolved materials, which, on their reascent, is likewise deposited in the higher rocks. Thus the movements of water below the drainage-level of the country inevitably operate to bring from below and deposit in the upper parts of the crust large amounts of mineral matter.

The nature of the forces which urge dike-stones from the deeper to the more elevated parts of the crust are not so clear as those involved in the formation of veins. It seems not unlikely that it is to the expansive energy of the contained water that we owe, in part at least, the upward movement of such materials. It is clear that this is the case in true volcanic dikes, for all the phenomena of a volcano indicate that the mainspring of its movements is to be found in the vapor of water. The close likeness between ordinary volcanic dikes and those which we cannot assuredly connect with volcanoes leads us to the conclusion that all injections whatsoever are most likely due to expanding vapors. Be this as it may, the effects of dikes is to clearly remove the material from a great depth, and place it in more superficial rocks.

Although it is most likely that the crevices into which dikes find their way may occasionally owe their dislocations to the action of contraction attending on certain metamorphic changes, probably the greater part of such ruptures are due to strains connected with changes in the attitudes of the rocks. The dike material thus acts as wedges to fill in all the cavities accessible to the igneous rocks, as far as they are formed. It is evident, that, where this process is numerously repeated, a considerable horizontal extension of the rocks is necessarily brought about. Thus in many parts of New England, as is well shown along its extended shore-line, where the coast reveals the crystalline rocks, from one-tenth to one-twentieth of the superficial area is occupied by such dikes. Generally, where the conditions have been such as to induce an injection of dikes, there is a large amount of vein matter deposited in the same field which still further serves to produce an extension of area. Thus in the region about Eastport the gain in the superficial area due to these two causes amounts to somewhere near three per cent or five per cent of the superficies exposed on the present surface of the rock.

Let us suppose that within any area of the earth's surface the conditions are such as to favor, through the forces which lead to vein-building and those which operate to create dikes, the vertical migration of matter from considerable depths towards the surface. The result on the tensions in the crust at such a point will evidently be such as to favor the construction of mountains. The constant abstraction of material from the depths will lead to a diminution in the bulk of the deposits of that lower level, and a parallel augmentation of the strata nearer the surface. It may well be that the differential contraction of the earth's mass, being greater at lower levels than at higher altitudes in the section, may create a slight tendency to buckle into mountain-ridges in all parts of the crust: but, wherever this general contraction is combined with the crenitic action, we may expect to find a more complete development of mountain-chains; and such points will be the seats of folding, and they may by their wrinkles effect the necessary contraction of the crust, and thus prevent folding in other sections where the contraction of the whole sphere alone tends to produce wrinkling.

It seems to me that this hypothesis may, perhaps, explain the fact that regions which have long been the seat of active sedimentation naturally become the sites of mountain-building. James Hall and others have noted the fact, which so far has remained inexplicable, that the first stage in mountain-building consists in the production of extended sedimentary deposits of more than normal thickness. During the deposition of these sediments the earth's crust appears to be down-borne by their weight. After the subsidence some action sets up which leads finally to a certain elevation of the area, and consequently to a development of erosive action. As the deposits are worn away, the mountains rise higher and higher, as the folding becomes more and more intense.

Although the generalization concerning the formation of mountains which I have just stated has not been critically compared with the many instances of mountain-structure, it seems of sufficiently common occurrence to demand an explanation, and it very likely will prove true for all large mountain systems whatsoever. Is it not possible that we may account for the development of mountains through these series of changes in the following manner? viz., where, as along a shore-line, sediments are thickly accumulated, the first effect may well be the down-sinking of the region; then, as the thickness of the stratified section increases, and the blanket retaining the internal heat becomes deeper, the internal heat will be greatly increased in the lower portions of the section. This will induce an upward migration of the imprisoned waters, and consequently, in time, a transfer of material to higher levels in the rocks. The consequent expansion of these superjacent rocks will make them tend to buckle. The superficial strata may not have received any considerable infiltration or injection of the material, yet they may be contorted by movements in the subjacent rocks which have thus been increased in volume; in other words, an intensification of deposition, if the sediments attain a great depth, may in time lead to a reversal of the down-sinking movement and the construction of a mountain system in what was previously a basin of sedimentation.

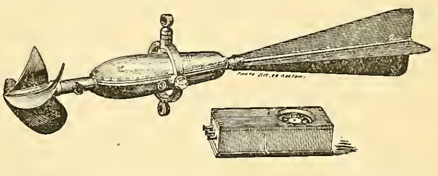
This explanation of mountain-folds will probably not at all account for the development of the basilar uplifts or tableland elevations which are developed in connection with all or almost all important chains. It may well be the fact that the expansion of the overlying deposits through the upward deportation of matter is only one element in determining the formation of mountains. It may in the end turn out that mountains are the result of a tolerably complicated series of causations, in which secular refrigeration of the earth, the transfer of weight by the operations of erosion and deposition, and the subterranean migrations of matter, all take a part. It may indeed well be the fact that these internal movements of material are due to more than one cause. I am, however, inclined to believe that to this vertical movement of materials we owe in many cases a share of the conditions which bring about the formation of mountainous dislocations. N. S. SHALER.

SCIENTIFIC NEWS IN WASHINGTON.

A New Instrument for measuring the Direction and Velocity of Submarine Currents. — Cabinets of Typical American Rocks, for Use in Colleges and Universities. — Beautiful Specimens of New Jersey Serpentine. — Ojibwa Pictographs in the West. — The Yellow-Fever has disappeared from Florida. — Interesting Phenomenon at Sea.

A Direction-Current Meter.

THE increasing commercial importance of our rivers and harbors, and the recent large annual appropriations for their improvement, have given a fresh impetus to the study of physical hydrography and hydraulics. It has come to be pretty generally recognized that no plans for the permanent improvement of tidal harbors, and such streams as the Mississippi and its tributaries, can be perfected without a thorough knowledge of the physical laws which underlie the complex phenomena they present. The investigation of these laws has stimulated observers and experimenters to the invention of many new and improved devices for the precise measurement of the various factors involved. One of the most interesting of these devices is a direction-current meter, recently perfected by Mr. E. S. Ritchie, the well-known maker of philosophical apparatus, of Boston, and Mr. E. E. Haskell of the United States Coast and Geodetic Survey. The characteristic feature of this meter is that it gives simultaneous measures of the direction and speed of a current. The direction is determined by means of a compass in all respects similar to Mr. Ritchie's trailing compass, which is mounted in an elongated chamber, whose axis coincides with the axis of the meter (see accompanying cut). A system of electro-magnets and



circuits connects the compass with a dial, which may be placed in any convenient position, in such a manner that the observer may make the dial indicate the same azimuth as the compass-needle. The speed of the current is measured by a conical propeller-wheel, whose flukes are curved in conformity with the requirements of theory for maximum rotary effect of moving water, and whose mass is as small as practicable with its requisite stability. The revolutions of the wheel are counted automatically by an electrochronographic register. The magnetic azimuth of the meter can be measured within a degree or two, and it is thought that current speeds as low as two-tenths of a foot per second can be accurately registered. This meter was used by the Coast and Geodetic Survey parties in their observations of currents in New York harbor last summer, and proved highly effective.

Cabinets of Typical American Rocks.

About four years ago Major Powell concluded to make a collection of all the typical rocks of the United States, systematically and scientifically arranged, so that a student of mineralogy, by comparing any piece of rock he might find with a corresponding specimen in the test collection, and studying the descriptions which would accompany the latter, might determine the name, composition, and proper classification of the unknown piece of rock he had in his hand. When this collection of typical rocks was complete, Director Powell proposed to have a number of duplicates of it made for gratuitous distribution to the leading colleges and universities of the country, for use in the classrooms as aids to the teaching and study of mineralogy.

Instructions were therefore issued to all the field-parties of the Geological Survey to collect and bring in specimens of the typical rocks of the regions they visited, and at first the work went on bravely. But what was everybody's business soon became nobody's business, the work of collecting was neglected, and finally little or nothing was done about it.

But Major Powell was unwilling to give the matter up, and about a year ago he assigned Prof. J. S. Diller especially to the work, and during the past few months it has been pushed forward with great vigor. A complete set of specimens of the typical rocks of the United States will be sent to the Cincinnati exhibition, and the work of preparing the duplicates is progressing very rapidly. Each set will consist of from one hundred and thirty to one hundred and forty specimens, each four inches long, three inches wide, and one inch thick; and there will be a pamphlet to accompany the collection, giving a description of each specimen. Two hundred of these sets are being prepared, and will be ready for distribution in about a year to those colleges and universities which file with Director Powell official application for them, and agree to make the use of them for which they are designed.

It will be impossible, of course, in a brief notice like the present, to give any thing like an adequate description of one of these collections; but a few outlines may convey to the reader some idea of their scope and the plan upon which they are arranged. Each collection will be divided into two departments. The first will be a sort of alphabetic collection, intended to show the general conditions of rocks, their structure, means of alterations, etc. For instance: one specimen will show a stratified rock, and another an unstratified one; a veined rock will be exhibited, also specimens of rocks jointed in various ways, those containing ripple-marks, limestone weathered by rain, spheroidal weathering in eruptive rocks and shale, rocks changed by the crumpling of strata, etc. In the second division the separate classes of rocks will be represented in their varying forms. For instance: in showing the stratified rocks not metamorphosed, the first specimen will be loose pebbles, or simple masses not cemented together; the second will show these simple masses partially cemented; and the third will show them entirely cemented, like the mill-stone grit and Roxbury puddingstone. In the same way a specimen of loose sand will be shown, such as is found upon the seashore; then sandstone like many of those of the East, where the grains are cemented by oxide of iron; then sandstone like the Potsdam, cemented by siliceous matter; and finally sandstone where the cement is carbonate of lime. Many different kinds and colors of sandstones will be shown, so as to enable the student to recognize by comparison any specimen of common sandstone he may have. In the same way the varieties of the other classes of rocks will be illustrated, — the volcanic; the limestones of every texture, variety of color, and degree of purity; infusorial earth and deposits of hot springs; gypsum; specimens showing all these rocks metamorphosed; sedimentary rocks; eruptive rocks; lavas of the same composition as granite, that came to the surface; and specimens ranging from the most acid granitic rock to the most basic.

From this brief outline it may be seen of what great practical value each of these collections may be made, if used as Major Powell designs that they should be. About forty institutions have already made application for sets.

Fine Specimens of Serpentine.

Among the mineralogical specimens which the National Museum will send with its collection to the Cincinnati exhibition will be some pieces of serpentine which are more beautiful, probably, than any previously exhibited in the United States. They were found in the Gordon limestone-quarry, near Montville, Morris County, N.J., and were collected by Prof. W. S. Yates, who was sent to Montville by the National Museum last summer for the purpose. The specimens are of a light yellowish-green color, differing entirely from the pure green serpentine metamorphosed from olivine rocks, which occurs in mountain-masses near both the Atlantic and Pacific coasts.

Prof. G. P. Merrill, curator of rocks, etc., at the National Museum, who has studied these specimens, has determined that the serpentine has been derived from the alteration of pyroxene; in fact, in nearly all the specimens the process of alteration is incomplete, the serpentine surrounding the pyroxene, which remains unaltered in the centre. A number of the specimens, ranging from a few inches to a foot and a half in diameter, have been cut open, and the exposed surface polished in the laboratory of the Geological Survey, and these show the structure and bring out the colors very beautifully.

These specimens are found in comparatively small masses, — from a few inches to a few feet in diameter, — irregularly distributed through the limestone, and the pyroxene from which it is derived occurs only in such limestone as has been metamorphosed by the mountain-building forces. The only other locality in which similar serpentine has been found in the United States and described is in the Leadville region, Colorado, where it was discovered by Professor Emmons, and treated of in his recent report. A peculiarity both of the commoner serpentine derived from eruptive rocks, and also of that metamorphosed from pyroxene, is the frequent occurrence of slickenside, showing that the rocks have been subjected to great pressure and movement.

Some of the New Jersey serpentine has already been utilized in ornamentation.

Ojibwa Pictographs in the West.

"In the neighborhood of Odanah, on the Bad River," says Capt. Garrick Mallory of the Bureau of Ethnology, in a paper from which extracts have already been made in *Science*, "is a large, vertical, soft rock on which pictographs are still to be observed, although nearly obliterated. The objects figured are chiefly birds and quadrupeds, many of them being repeated, and are all probably totemic. Indeed, that is the direct evidence of an old Indian who saw some of them made in his boyhood. He says that when Indian visitors came by there, that being on a well-known trail, they would each cut his totem on the rock to show to what clan he belonged, either to establish his identity to the resident Indians who might happen to be present, or as a record of his passage. This is interesting in comparison with a similar proceeding in New Mexico and Arizona.

"In my examinations at three reservations in Wisconsin, I discovered some variants of the Medé ceremonies. The full ceremonies of the Medé lodges, which they call 'grand medicine,' were performed twice a year, — in the fall and in the spring. Those in the spring were of a rejoicing character, to welcome the return of the good spirits; those in the fall were in lamentation for the departure of the beneficent spirits. The drums were beaten four days and nights before the dance, which lasted for a whole day. After the dance twelve selected persons built a lodge, about the centre of which were stones, which were heated, and dancing went on around it until the stones were moistened by the sweat of the performers. Singing, of course, was an accompaniment of the dances. These ceremonies were performed by the body of the people, and were independent of the initiations of the secret order. With regard to the candidates who passed initiations, it was observed that they always became stronger and better men; perhaps because those were the ones who had the requisite strength of mind and body to endure the various ordeals, and to understand the mysteries.

"The general remark may be made with regard to the Ojibwa in the several localities where they are now found with the least amount of civilized influence, that they in a marked degree live a life of religious practices, and that their shamanistic societies have a wonderful influence over their sociologic and religious character. This is to so great an extent (before not appreciated), that, in my opinion, a careful study of these people will develop facts corresponding in interest with those which have recently surprised the world as reported by Mr. Cushing among the Zuñi. There is probably no body of Indians in the United States whose inner life can now be studied to greater advantage than the remoter bands of the Ojibwa. With reference to the subject with which this paper is more directly concerned, that is, pictographs in their various modes of representation, it is certain that the understanding of the mythology and religion of these people will furnish the best interpretation to their ancient drawings and etchings.

"It is desirable to explain the mode of using the Medé and other bark records of the Ojibwa. The devices are not only mnemonic, but are also ideographic and descriptive. They are not merely invented to express or memorize the subject, but are evolved therefrom. A general mode of explaining the so-called 'symbolism' is by a suggestion that the charts of the order, or the song of a myth, should be likened to the popular illustrated poems and songs lately published in *Harper's Magazine*; for instance, 'Sally in our Alley,' where every stanza has an appropriate illustration. Now, suppose that the text was obliterated forever, — indeed, the art of reading lost, — the illustrations remaining, as also the memory to many persons of the ballad: the illustrations, kept in order, would supply always the order of the stanzas, and also the general subject-matter of each particular stanza, and the latter would be a reminder of the words. This is what the rolls of birch-bark do to the initiated Ojibwa, and what Schoolcraft pretended, in some cases, to show, but what, for actual understanding, requires the obtaining of the literation of the actual songs and charges of the initiation ceremonies, or in other instances the literation in the aboriginal language of the non-esoteric songs and stories."

Yellow-Fever in Florida.

Dr. Jerome Cochran, of the State Board of Health of Alabama, in a recent report has stated that the late epidemic of yellow-fever in Florida was not introduced into the State by the usual trade channels, but by smugglers. This confirms unofficial statements received by Supervising Surgeon-General Hamilton, of the marine-hospital service, several weeks ago. Dr. Cochran says that the last case was discharged May 11, and the last death May 8, and that there have been active precautions taken to prevent the reappearance of the disease.

Interesting Phenomenon.

Captain Friis, of the Norwegian steamship 'Viking,' reports to the Hydrographic Office that he observed at midnight, April 20, between Chatham and Davis South Shoal, when the moon was in its last quarter and about two hours above the horizon, two dark-looking narrow strata of clouds; the upper one extending across the face of the moon, the upper and lower limbs of the latter appearing above and below the cloud-stratum. The cloud was moving south-westerly. On the same line with the moon, and to the westward of it, was a nearly circular luminous spot, larger than the moon, which looked as the sun might when shining through a thick mist. The second stratum of cloud was about halfway between the first and the horizon. The phenomenon continued until the moon set at two o'clock, when there shot upwards from the upper limb fan-shaped rays of light.

HEALTH MATTERS.

Yellow-Fever.

In a recent number of the *Medical Record* is published a letter from Dr. Charles Finlay of Havana, dated April 17, 1888, in which he says, —

"In your issue of April 7 there is a short paragraph stating that the microbe of yellow-fever described and cultivated by Dr. Domingos Freire of Rio Janeiro 'has gone the way of many other specific germs,' your grounds for this assertion being that Dr. Gibier 'denies utterly the existence of the germ claimed to be specific.' This conclusion has evidently been come to under the impression that the Parisian bacteriologist just mentioned has had full opportunities for verifying in Havana, within the brief space of six weeks, the results previously obtained in Brazil by Dr. Freire, in such a manner as to warrant his abrupt denial of what he had so warmly approved while experimenting in Paris upon Dr. Freire's Brazilian cultures. That such has not been the case, I think you will admit after hearing the particulars of that investigation.

"Dr. Gibier saw his first yellow-fever case on Nov. 16, at the military hospital of this city. Between that date and Dec. 28, he examined altogether five patients, and performed four autopsies. He collected fresh blood from four of the patients, and urine from three, besides the pieces of viscera and secretions from the cadavers. In the urine of the first patient he thought at first that he had recognized Dr. Freire's micrococcus, but afterward changed his mind, having 'satisfied himself' that what he had seen were mere insignificant organic granulations. In the blood and secretions, as also in the sections of viscera, he failed to discover any micro-organisms, nor did he succeed in developing any colonies in his numerous attempts with the same pathological material. One of the tubes of agar-agar jelly inoculated by him with heart-blood, and presented to a military colleague, did, however, develop a yellow superficial colony, which Dr. Gibier attributed to an accidental atmospheric contamination, although the constituents of the colony turned out to be a tetragenous microbe quite distinct from the plain atmospheric micrococcus with which he had thought it could be identified.

"This scanty material, collected at a time when yellow-fever was sporadic in Havana, almost the only cases signalled being those present at the military hospital, constitutes the sole foundation for the abrupt retractation of Dr. Gibier from his former enthusiastic advocacy of Dr. Freire's views; never considering that the sporadic and epidemic forms of the disease might not be identical, any more than the equivalent forms of cholera have turned out to be, notwithstanding their clinical resemblance. Other observers had previously noticed that the same yellow-fever products which, in their hands, had given colonies when collected from epidemic cases, failed to do so with the sporadic. In collecting blood from yellow-fever patients, Dr. Gibier was noticed to disinfect the skin with bichloride solution, but took no pains to remove any excess of the germicide which might remain and sterilize the drop of blood as it would ooze out on the surface. Neither does it appear that he varied his culture-media as to acidity, alkalinity, etc., nor that he kept his tubes at a uniform summer temperature. Yet, in spite of such obvious deficiencies, Dr. Gibier does not hesitate to condemn as erroneous the results of Dr. Freire's patient and laborious investigations, and likewise all others that might claim to have obtained successful cultures from similar yellow-fever products.

"Dr. Gibier had brought over some cultures proceeding from Dr. Freire's own tubes, inoculated at Rio Janeiro; and shortly after his arrival in Havana, full of faith in their prophylactic virtue, he inoculated himself, and thought he had gone through the phenomena of an experimental attack of yellow-fever. In this, I fancied at the time, and he now acknowledges, that he was mistaken; but after examining my own cultures from yellow-fever blood and urine, obtained by me last summer in Havana, and cultivated in sub-acid agar-agar jelly, he has repeatedly declared that both macroscopically and microscopically they were identical to Dr. Freire's. This coincidence, one would think, should have checked his precipitancy, and induced him, at any rate, to wait until the epidemic season before formulating his conclusions.

"The only excuse, if so it can be called, for such haste in a practised bacteriologist, must lie in his unacquaintance with the disease, and in his anxiety to proclaim a new bacillus of his own, isolated from the intestinal contents of yellow-fever cadavers, and which he believes better entitled than its fellow claimants to be considered as the true yellow-fever germ.

"My object in bringing forward these facts is to guard the American medical public against hasty deductions, and to show that Dr. Gibier's researches have not in any way altered the previous state of the question, except in so far that he has added another microbe to the list of the possible specific germs of the disease."

This would seem to make it very doubtful whether Dr. Gibier of Paris has added any thing to our knowledge of the cause of yellow-fever.

ELECTRICAL SCIENCE.

Novel Current-Registering Instrument.

A NEW instrument for measuring the quantity of current supplied to consumers has been recently brought out by Prof. Elihu Thomson, although it seems probable that the principle on which it works was originally due to Tavener. Two bulbs are connected by a U-shaped tube, and the whole is partly filled with liquid; alcohol, for instance. The arrangement is pivoted, so that, if more of the liquid is forced into one of the bulbs, the difference of weight will cant the apparatus, and its movement is communicated through a ratchet to the hands of a registering-dial. To make this measure the current, two spirals of wire are introduced into the liquid, one in each bulb. If we suppose the instrument has been canted, the spiral in the lower bulb has its circuit made, while that of the upper spiral is broken. The consequence is, that the liquid in the lower bulb is heated, its vapor-tension increases, and part of it is driven through the U-tube. The section of the latter is very small, so that the liquid passes slowly; but in a time, depending upon this section and on the rate of heating, the upper bulb becomes the heavier, and the apparatus cants, breaking the circuit of the spiral that was previously made, and making the other. By a suitable registering system the readings may be made proportional to the current which is flowing. The current, then, is measured by its heating effect, and the instrument may be used for both direct and alternating currents. In the latter case the readings would be fairly correct if lamps only were used; but, if motors were to be run, the readings would not be proportional to the power consumed. This objection holds with all of the instruments that have yet been proposed for the measurement of the consumption of alternating currents.

THE SHORT SERIES ELECTRIC RAILWAY SYSTEM. — The Short system of electric traction differs from those ordinarily used in that the current is distributed in series, the same current passing through all of the cars on the line. Both overhead and conduit wires are used. In the latter case the wires are contained in an iron conduit, from which they are insulated by porcelain brackets. The overhead wires are supported from iron bracket-poles that arch gracefully over the track. The motors and generators used are of the Brush system. The motor is usually in a front compartment, and is geared to the front car-axle. There is a pinion on the motor-shaft, a gear on the axle, and an intermediate gear and pinion that further reduces the number of revolutions. The gears are made of steel, the pinions of rawhide held between steel plates, making an efficient and noiseless transmitting system. The front compartment (in which the driver stands), with the motor and front truck, can be made separately, and attached to any ordinary car by removing the front platform. Taken altogether, the system seems a simple and efficient one.

AN IMPROVEMENT IN SECONDARY BATTERIES. — A seemingly slight improvement in the construction of secondary batteries, and yet one that in certain cases will be of considerable value, has recently been patented by Mr. J. S. Sellon. A great difficulty and expense in the use of accumulators arises from the fact that the plates cannot be separately and easily removed. Usually, if we wish to connect a number of cells in series, all of the positve plates in each cell are connected together by lead strips, which are taken to similar strips connecting the negative plates of the next cell. The terminals of each plate are burned to the connecting-strip; and when one of the plates gives out, and we wish to renew it, we must take out the complete set of plates, cut off the one we wish to renew, and solder on another. Besides being difficult, this takes a good deal of time, and increases the cost of maintenance of the battery; it is obvious, too, that it interrupts its use. Mr. Sellon's idea is to have plates made in pairs, a positive and negative, so connected that when one of them is in one cell the other will be in another. The first and last cells have one set of single plates connected with the terminals of the external circuit. The advantages of this arrangement are, that plates can be removed and renewed without interfering with the action of the battery, and much more easily than if one of a number of connected plates had to be removed. Any improvement in storage-batteries is important at this time, when its advantages, especially for tramway-work, hang in the balance. A slight increase in efficiency will cause their adoption for street-car work, and the invention of Mr. Sellon is in the right direction.

INFLUENCE OF TEMPERATURE ON THE MAGNETIZATION OF IRON. — M. C. Ledeboer has made some interesting experiments on the magnetic properties of iron at high temperatures. Many experiments have been made on the same subject; and it has been found that up to three or four hundred degrees there is no great change in the magnetic permeability of iron, while at a red heat its magnetic properties almost entirely disappear. The necessary temperature of the iron bar used in the experiment was obtained by a spiral of platinum wire wrapped around it, separated from it by a layer of mica. Between the platinum and the iron was a small thermo-electric couple, which was used to measure the temperature of the bar. A heavy electric current sent through the platinum spiral could be regulated to give any desired temperature. The bar used was thick as compared with its length, which fact prevented any useful results as to residual magnetism being obtained. M. Ledeboer arrives at the following results: up to a temperature of about 680° the magnetic permeability remains nearly constant, after 680° the diminution is very rapid, and the iron ceases to be magnetic at 760°. This range of temperature is about that in which several curious phenomena occur, — an abrupt change in the specific heat, a change in the tortional co-efficient, etc.; and it is probable that a more complete study of iron in this region of temperature will help us to connect phenomena which seem now so different in character.

THE MORDEY ALTERNATING-CURRENT DYNAMO. — This dynamo has revolving magnets and a fixed armature. The latter consists of a number of coils of narrow copper ribbon wound on insulating-cores: they are fixed to project from the inner circumference of a metal ring which is fastened firmly to the bed-plate of the dynamo. The magnet consists of a short iron core, whose axis is the axle of the machine, and which is wound with wire supplied with current from the small dynamo used as an exciter. From each end of the magnet extend arms, which are bent until they are opposite one another, leaving only enough space between for the flat coils of the armature to pass. We thus have a number of poles of the same sign, opposite to which are poles of the opposite sign, while between the poles are vacant spaces. The action of the machine is now easily understood: as the magnet revolves, the armature coils are first opposite pole-pieces, where a number of lines of force pass through them; then in vacant spaces, where there are no lines of force. The variation, of course, produces the electro-motive force of the machine.

INCANDESCENT LAMPS IN EXPLOSIVE GASES. — Lieutenant Hutchins, U.S.N., has been experimenting on the effect of breaking incandescent lamps in explosive gases. The filament of the lamp breaks almost immediately that the glass is broken, and as soon as it breaks, of course, and cools down, the danger is over. The question was whether the breaking and cooling were so rapid that the gases would not be brought to a sufficiently high temperature to explode. With a Swan 16-candle power lamp, in a mixture of hydrogen and oxygen, the gas exploded immediately the bulb was pierced: the filament was not broken. The same result was obtained with marsh-gas. A Maxim lamp was tried in a mixture of coal-gas and air, with a similar result. Lieutenant Hutchins concludes, that, where explosive gases are allowed to collect on board ship, incandescent electric lights are dangerous.

BOOK-REVIEWS.

A Text-Book of Biology. By J. R. AINSWORTH DAVIS. Philadelphia, Blakiston. $4.

THE number of text-books of biology which have been published within recent years has been, it would seem, sufficiently great to meet all reasonable demands; and yet, after perusing this new one by Mr. Davis, we are satisfied that it supplies deficiencies which exist in all the text-books which have up to this time appeared. While the others have been largely practical, this one is more theoretical, and, as is indicated on the titlepage, is especially designed to prepare students for their scientific examinations. This design is further elaborated in an appendix, which contains a full bibliography of the works referred to in the text, a series of examination-questions, and an index-glossary. The volume is divided into two parts, — a botanical and a zoölogical, — each of which deals with a number of types morphologically and physiologically, then briefly draws out the points of comparison between them, and ends with an outline of classification.

In Part I., which treats of vegetable morphology and physiology, fungi are first considered; *Saccharomyces, Bacteria, Mucor mucedo*, and *Penicillium glaucum* being selected as types. Of *Algæ*, the author describes *Protococcus pluvialis, Spirogyra, Fucus, Chara*, and *Nitella*. *Funaria* and *Polytrichum* are selected as representing the mosses; *Pteris aquilina* and *Nephrodium filix-mas*, the ferns; *Pinus*, the gymnosperms. The consideration of the angiosperms follows.

In Part II., which is devoted to animal morphology and physiology, the *Protozoa* are first dealt with through their representatives the *Amœba* and *Vorticella*. The *Hydra* represents *Cœlenterata; Distoma* and *Lumbricus, Vermes; Astacus, Arthropoda; Anodonta* and *Unio*, and *Helix, Mollusca; Rana, Amphibia; Columba livia, Aves; Lepus cuniculus, Mammalia*.

No less than one hundred and fifty-eight well-executed illustrations add to the attractiveness of the book, as well as elucidate the text. We recommend the work not only to those for whom it was originally designed, but to all students and readers who desire to obtain within a small compass the most recent reliable information on the subjects of vegetable and animal morphology and physiology.

Ethics of Boxing and Manly Sport. By JOHN BOYLE O'REILLY. Boston, Ticknor. 12°. $1.50.

THE main purpose of this book, as stated by its author, is to bring into consideration the high value, moral and intellectual as well as physical, of those exercises that develop healthy constitutions, cheerful minds, manly self-confidence, and appreciation of the beauties of nature and natural enjoyment. He further says, that so long as large numbers of our young people of both sexes are narrow-chested, thin-limbed, their muscles growing soft as their fat grows hard, timid in the face of danger, and ignorant of the great and varied exercises that are as needful to the strong body as letters to the informed mind, such books as this need no excuse for their publication.

The contents of the volume are subdivided into four sections: 1. The ethics and evolution of boxing; 2. The training of athletes tested by every-day life; 3. Ancient Irish athletic games, exercises, and weapons; 4. Canoeing sketches. Under the first the author discusses the question whether boxing has a real value. He believes that it has, and in support of his belief quotes the opinions of Sir Robert Peel, Mr. Evelyn Denison, Lord Althorp, Dr. Oliver Wendell Holmes, and others. Lord Althorp, the minister who led the British Commons when the Reform Bill was passed, was evidently an enthusiast on this subject. He said that his conviction of the advantages of pugilism was so strong that he had seriously been considering whether it was not a duty that he owed to the public to attend every prize-fight which took place, and thus to encourage the noble science to the extent of his power. In speaking of the improvement in modern boxing, the author believes that the English practice of prize-fighting with bare hands and under improper rules has brought boxing into disrepute. He praises Sullivan for having made a manly effort to establish the practice not only of sparring, but of fighting, with large gloves, and for insisting that contests should be ruled by three-minute rounds of fair boxing. The Grecian athletes, their training and skill, and the gladiators of Rome, are referred to and described. Feudalism suppressed popular athletic exercises. With the advent of chivalry, the art of boxing waned and became unfashionable. With the advance of feudalism came the growth of iron armor, until at last a fighting man resembled an armadillo: he was iron-clad from top to toe. The first modern champion boxer was James Figg, who was considered, in 1729, as the national champion. The first rules for the government of 'the ring' were prepared by Broughton, and were in force from 1743 to 1838.

In discussing the training of athletes as tested by every-day life, the author considers the question from two different standpoints, — that of the professional athlete, and that of the average person who wants to get into lasting 'good condition.' He thinks that the mass of those who live in cities, and whose occupations involve little manual or physical exercise, allow their bodies, at an early age of manhood, to sink out of all trained and athletic strength and shapeliness. He says that it is only necessary to visit a Turkish bath to find abundant evidence of the muscular collapse which has overtaken the modern city-dweller, — bodies 'developed' everywhere in the wrong direction, arms like pipe-stems, while the beautiful muscles of the shoulders and back are smothered in layers of vile fat, and spindle thighs and straight calves weakly support bellies like Bacchus. Excellent hints are given on training and the ways of promoting good health. A large number of illustrations make the volume very attractive, and accounts of canoeing on the Connecticut, Delaware, and Susquehanna Rivers add to the interest which its perusal has excited. The book, taken as a whole, is unique, and treats of questions which have seldom been so well and so thoroughly handled.

Medical Nursing: Lectures delivered in the Royal Infirmary, Glasgow. By J. WALLACE ANDERSON, M.D. 3d ed. Glasgow, James Maclehose & Sons. 16°. $1.

FOR many years the nurses at this Royal Infirmary of Glasgow have been practically trained in the duties pertaining to their profession. About ten years ago the managers resolved that a course of systematic lectures on nursing should be added to the practical training; and Dr. Anderson was selected to deliver the medical lectures, which are contained in the volume before us. In ten lectures the author has succeeded in condensing a vast amount of information. Modern nursing dates from the year 1836, when Theodore Fliedner, a German-Protestant clergyman, established the Deaconess Institution at Kaiserwerth on the Rhine. There, under the superintendence of himself and his wife, a training-school for female nurses was begun. The labors of Florence Nightingale, with her staff of thirty-seven nurses, in the Crimea, in 1854, are too well-known to need more than a reference. It was from such work as this of Fliedner and Florence Nightingale that all the training-schools for nurses have come. There is now hardly a hospital in the United States that has not such a school in connection with it. The lectures of Dr. Anderson deal with subjects which are essential for every nurse to know: how to obtain and record a patient's temperature, pulse, and respiration; how to prepare food for the invalid so as to make it both nutritious and palatable; how to prevent bed-sores; how to prepare fomentations and poultices. These and many other practical lessons are thoroughly taught in this little volume. In an appendix the author gives valuable recipes for the preparation of food for the sick, and a list of poisons with their antidotes. One feature of the book which we regard as of considerable worth is a list of questions at the end of each lecture. These questions bring out the salient points of the lectures, and direct attention to the most important subjects for study. There have been published other and more pretentious text-books on nursing, but we know of none that in so compact a form contains so many essentials as 'Medical Nursing.'

Bradley's Atlas of the World, for Commercial and Library Reference. Philadelphia, WILLIAM M. BRADLEY & BROTHER, 1887. f°. $25.

THIS atlas has received high praise from Dr. McCosh, Professor Libbey, Dr. Vincent, General Hazen, and others. The intention of the work is to provide a complete American and foreign atlas, full and detailed, for both hemispheres. Following a somewhat novel plan for an American atlas, the eastern hemisphere is given first. But it is the belief of the publishers that every portion of the world is equally treated. The maps contain the results of recent investigations, so far as this is possible in any atlas of this size, and each map is accompanied with an isometric index. By means of this index the position of all places indicated on the maps may be readily found. For American towns the population is given with the index. For the eastern hemisphere a separate population table is given. Throughout the work it has been a fixed aim to render the maps easily legible, and not tiresome to the eye in consultation.

NOTES AND NEWS.

THE committee appointed by the New Jersey Assembly of the Agassiz Association at its semi-annual meeting, held in the chapel of Rutgers College, May 12, to arrange for a seaside assembly during the coming summer, organized itself by the election of Rev. L. H. Lighthipe, Woodbridge, N.J., as chairman, and Prof. P. T. Austen of Rutgers College, New Brunswick, N.J., as secretary. The plan as sketched out by the committee is somewhat as follows. The assembly is to be known as the 'Agassiz Seaside Assembly.' Its membership is to consist of such persons as shall send their names to the secretary before the opening of the assembly, or such as shall be elected members according to by-laws adopted afterward. It is proposed to make it a permanent organization; the membership fee to be one dollar per year, payable at the opening of each annual assembly. Membership badges and tickets will be provided for all who send in their names to the secretary. It is proposed to hold a six-days' session this year, at Asbury Park, N. J., provided suitable accommodations can be secured at that place in the month of August. The subjects to be discussed this year will be principally botany and entomology, under the direction of such practical specialists as can be secured. The work is to include several field-day excursions with experienced guides. Circulars setting forth these facts will be sent to all chapters within a radius of one hundred miles, and to any other chapters which may desire them. Chapters failing to receive them, or any persons desiring copies, can obtain them by addressing the secretary, Prof. P. T. Austen, Rutgers College, New Brunswick, N.J. Members will be entitled to free admission to all lectures and excursions, and will receive circulars before the opening of the assembly, giving full particulars as to time, place, railroad-trains, boarding accommodations, programme of exercises, etc. Membership is not limited to members of the Agassiz Association. It is extremely desirable that names be sent in as soon as possible, that the committee may know how far they may venture in the matter of expenses. All members of the Agassiz Association are cordially invited to co-operate with the committee in making the Seaside Assembly a success.

— According to the *Publishers' Weekly*, a gypsy-lore society has just been formed. The president is Mr. C. G. Leland; the vice-president, Mr. H. T. Crofton; and the members already include the Archduke Joseph of Hungary, Sir Richard Burton, M. Paul Bataillard, Dr. Alexander Paspati, and several more English and continental students of Romany. The society will publish a quarterly journal, the first part of which will appear on July 1, and copies of which will be strictly confined to members. The honorary secretary is Mr. David MacRitchie, 4 Archibald Place, Edinburgh.

— At a late meeting of the mineralogical branch of the New York Academy of Sciences, Mr. George F. Kunz described some remarkably complicated twin diamonds which have proved to be unusually hard. Some of these will be sent to Professor Rowland of Johns Hopkins University, Baltimore, for use in ruling the diffusion gratings he is making, and using in mapping the spectrum of the sun.

— A new slang dictionary is announced by the *Publishers' Weekly*, which will aim at exceptional completeness by enlisting the co-operation of specialists in different departments. The editors-in-chief are Prof. Albert Barrère of Woolwich, author of 'Argot and Slang,' and Mr. Charles G. Leland (Hans Breitmann); and among the contributors are the Earl of Suffolk, Sir Patrick Colquhoun, Major Arthur Griffiths, Dr. Charles Mackay, Mr. John Hollingshead, Rev. J. W. Horsley, and Prof. Douglas B. W. Saden. The character of the work may be judged from its sub-title: 'A Dictionary of Unconventional Phraseology, embracing English, American, and Colonial Slang; Tinker's, Yiddish, Pidgin, and Anglo-Indian Slang; Quaint Expressions, Vulgarisms — their Origin, Meaning, and Application.' It will be issued in two volumes, to subscribers only. Applications for the work should be addressed to G. May, care of Messrs. Whittaker & Co., 2 White Hart Street, Paternoster Square, London.

— Professor Langley, secretary of the Smithsonian Institution, has asked for an appropriation of $27,050 for the expenses of the system of international exchanges between the United States and foreign countries under the direction of the Smithsonian Institution, instead of the $15,000 previously estimated for. In his letter of explanation he says that there is now an amount of matter (virtually presents to the United States) which could be secured if the institution had the larger sum at its disposal.

— The British Parliamentary Currency Commission will report in favor of the remonitization of silver. It proposes a convention of the leading commercial nations of the world to agree upon a system of weights and coinage under which gold and silver shall be exchanged in international transactions. If such an agreement could be reached, it would probably be a blessing to the world. No one nation can remonitize silver without the co operation of others, but the whole commercial world can do it.

— The feature of the meeting of the British Royal Society last week was an exhibition by Mr. Henry Burns of a class of nests of live ants. These were so arranged that all the elaborate internal economy of the insects could be fully observed. A cable despatch says that "in one cell was the queen, with servants attending upon her. In another were the aphides, or cows, watchfully herded by their keepers; and a party of workers were engaged in walling up an intruding queen which had been placed in the nest that morning. The state of ant civilization was so remarkably high, that nobody would have been much surprised at a party of scientific ants in spectacles taking notes on the Royal Society."

— The Nicaragua Canal surveying party, under Civil Engineer Menocal, have discovered that a new route, which they call 'the upper one,' is much more favorable for the line of the canal than the one recommended in 1885. By this new route it is said that the total length of the excavation from Ochoa to Greytown will not exceed nineteen miles, and will consist of several short embankments instead of one long one. The cost, it is said, will be greatly reduced, and the engineering difficulties much less.

— A new chemical process of producing aluminium, invented by Professor Curt Netto of Dresden, is thus described: "The ore used is cryolite, a double fluoride of aluminium and sodium, ground to a fine powder, and fluxed with common salt. The ore is then melted in a reverberatory furnace, and when quite liquid is run into a ladle. When in this condition, ingots of solid sodium are forced to the bottom of the ladle, and there held until they become volatilized. The gaseous sodium rising through the molten cryolite displaces a part of the aluminium, which collects in a metallic form at the bottom of the ladle. The greater part of the slag is then skimmed off, and the remainder poured into an iron crucible to cool. When the mass is turned out, a solid ingot of aluminium is found at the bottom."

— An item of interest in connection with the proposed introduction of 'World-English' is going the rounds of the press, crediting President Eliot of Harvard College with having said, "I sat down to dinner one stormy night, in a Swiss inn, with sixteen people. Six different nationalities were represented by these sixteen people, and the only language that they could all speak was English. One may travel now, as I have just travelled, through southern Spain, through northern Africa, through Greece and Constantinople, and back by Vienna, and the more usual routes, with nothing but English. I do not mean to say that you may not occasionally feel the need of some French words, but you can travel comfortably through all these countries with no language but English. That, I am sure, could not have been said twenty-five years ago. The spread of the language within that time for purposes of commerce is most noticeable, as is also the increased knowledge of the language and literature among educated people on the continent of Europe."

— The intention with which *The Universal Review* (London, Swan, Sonnenschein, Lowrey, & Co.; New York, International News Co.) has been founded is twofold, — that of supplying a journal of international character, and of making one interesting to all classes of readers. The services have been obtained of some of the best writers of France, Germany, and America, as well as those of England. Special correspondents have been established in the chief cities of the Continent, America, and the Colonies, who will supply information as to the principal political, social, intellectual, and artistic movements therein. A considerable portion of its space will be devoted to three matters which at present have almost entirely disappeared from review literature, — the arts of painting, fiction, and the drama. On all of these there are promised not only numerous articles, but examples of the best original work which is being done at the present time. Thus *The Review* will publish reproductions of fine pictures and drawings, ancient and modern. It will also differ from its serious contemporaries by including the subject of sport. The pages will be open to duly qualified correspondents, in the belief that there are many men, whose opinions are of value, who will welcome the opportunity of expressing their views on questions of the day in a manner at once less lengthy and less formal than is necessitated by a review article, and in a more permanent form than is afforded by the columns of a newspaper. As to the more serious political, religious, scientific, and scholarly matters, which must form the backbone of any important review, *The Review* will take no partisan view, and will admit opinions of every kind which seem to be founded upon adequate knowledge. —— Charles Scribner's Sons have published, in connection with the railway articles appearing in *Scribner's Magazine*, a pretty lithographed folder, entitled 'Twenty Questions and Answers about Railways.' The information contained is interesting, and has been obtained from well-known authorities. It can be obtained by enclosing stamp to the publishers. —— Two articles are promised in *The Popular Science Monthly* for July that are worthy of attention. They are an illustrated paper on 'Safety in House-Drainage,' by William E. Hoyt, S.B., in which the belief that plumbing-fixtures in our houses are inevitable sources of danger is controverted, and ways are shown for making them safe; and the concluding essay of the series on 'Darwinism and the Christian Faith.' —— D. Appleton & Co. have just gotten out the July number of their *Educational Notes*. This is profusely illustrated, and gives a most tempting summary of several of their newer educational books. —— H. Semler's 'Die Tropische Agricultur,' a handbook for the agriculturist and merchant, issued in parts by the Hinstorff'sche Hofbuchhandlung, Wismar, Mecklenburg, has just been completed. The work is of especial importance to those who give their attention to the cultivation of tropical products in the United States, such as oranges, lemons, cotton, maize, tobacco, sugar, etc. The International News Company of New York are the American agents for the work, which is complete in three large volumes. —— Messrs. Dodd, Mead, & Co., New York, have issued a new catalogue of rare and choice books, which they offer at discounts in view of the approaching summer season. Among them we note a copy of the first printed edition of 'Euclid,' the first book printed with woodcut diagrams. —— C. N. Caspar, Milwaukee, Wis., announces to appear in June, Linderfelt's 'English Volapük Dictionary.' —— Messrs. E. & F. N. Spon, New York, have just published 'A System of Easy Lettering,' by J. H. Cromwell. The author divides any surface he may wish to letter into squares (or parallelograms, as the case may be) in pencil-lines; forms the required letters in ink or paint, and according to the style chosen; then erases the pencil-lines, and the lettering is complete.

— Chauncey Smith says the magnitude of the commercial interests which have been called into being by physical discoveries and the devlopment of new ideas, indicates, that if the progress of the past few years is to continue, if new achievements are to rival those of the past, it must be by a higher education and training, not of a few men, but of the many, so that no germ of talent shall miss its opportunity for development and its chance for increasing the powers and resources of man.

— The Canadians themselves are ignorant of most of the vast mineral riches their country contains, and comparatively indifferent to what they do know, so that the revelations of a recent parliamentary committee report on the great Mackenzie basin are as unexpected there as here, according to the *Engineering and Mining Journal*. Of the minerals of this vast region, little is known. Nothing is known of the minerals which may exist east of the Mackenzie River and north of the Great Slave Lake. Enough is known of the western affluents of the Mackenzie, the committee thinks, to show that at the head waters of the Peace, Liard, and Peel Rivers there are from 150,000 to 200,000 square miles which may be considered auriferous; while west of the Rocky Mountains there is a metalliferous area, principally of gold-yielding rocks, 1,300 miles long and from 400 to 500 miles broad. Gold has been found on the west shore of Hudson Bay, silver on the Upper Liard and Peace Rivers, and copper on the Copper Mine River. Iron, graphite, ochre, brick and pottery clays, mica, gypsum, lime, sandstone, and asphaltum are also known to exist in the region. Salt is found in crystals and in saline springs. The evidence submitted to the committee points, in the language of the report, to the existence, in the Athabasca and Mackenzie valleys, of the most extensive petroleum-field in America, if not in the world. The committee suggests that 40,000 square miles of this territory be for the present reserved from sale, as it is probable that in the near future petroleum will rank among the chief assets of the Dominion. The committee bounds the reserved lands as follows: easterly by a line drawn due north from the foot of the Cascade Rapids on Clearwater River to the south shore of Athabasca Lake; northerly by the said lake-shore and the Quatre Fourche and Peace Rivers; westerly by Peace River and a straight line from Peace River landing to the western extremity of Lesser Slave Lake; and southerly by said lake, and the river discharging it, to Athabasca River and Clearwater River as far up as the source.

— The *American Engineer* states that at the foundery and machine-shop of Albert Russell & Sons, Newburyport, Mass., a locomotive engine is being made unlike any before. It is designed to run on the new 'bicycle railway,' which is the invention of Hon. E. Moody Boynton of West Newbury. The tracks are not both laid on the ground, as commonly. One is laid on the ground, and the other is laid on the under side of a framework which is above and directly over the lower track. The engine and cars have wheels on the bottom, and double trucks above. In this way the whole is steadied on the rail, and cannot fall over nor off the track. It is expected that great speed will be attained on account of the comparative lightness of the train, and also because of the loss of friction. The idea is patented in every country in Europe as well as in the United States and other nations of the western hemisphere.

— For many years past the Old Colony Steamboat Company have maintained, at a large expense, an oil lantern on the summit of the beacon on the southern point of Goat Island, Newport. In very bad weather it has been impossible for the man charged with lighting this lamp to effect a landing at this point, and therefore when the light was most needed it was frequently absent. Upon the summit of the beacon there has been placed a duplex socket carrying a 32-candle power lamp, supplied by the Sawyer-Man Company. This socket is so arranged that but one lamp of the pair burns at a time, the second lamp switching in automatically on the failure of the first. A cable one thousand two hundred feet in length is carried to the mainland. The end of this cable is connected with the distributing point of the torpedo station electric-lighting plant. The whole installation was supplied by the Okonite Company, material and work being subjected to the supervision and inspection of the officer commanding the torpedo station, Commander C. F. Goodrich, United States Navy, the Old Colony Steamboat Company paying all the bills. The beacon was first lighted for experiment on Friday night, June 1. This preliminary test proving satisfactory, the operation of the light was definitely installed on Saturday night. The details of the installation are so complete, and the insulation of wires so high, that failure of the lamp, at least for a long time to come, may be considered as a remote contingency.

— The Hydrographic Office has in preparation a report relative to the storm that caused such great damage off the coast about the middle of March, commonly known ashore as the 'New York blizzard.' Its terrific violence at sea, however, and the wide area which it covered, make it one of the most notable storms of the century in the North Atlantic. Special efforts are being made to collect all the data possible from vessels north of the 20th parallel and west of the 50th meridian at any time from the 11th to the 15th of March, and the co-operation of masters of vessels and foreign hydrographic offices has been earnestly requested. The data at hand are already very complete for the greater portion of the area in question, but additional information is specially desired from vessels about and to the south-eastward of the Bermudas at any time during the dates mentioned above, and, indeed, from vessels anywhere within the limits already stated.

— The logs from the great raft abandoned off the coast of New England a few months ago have drifted in a direction about east by south, and the greater part of them are now in the region between the 33d and 38th parallels and the 30th and 50th meridians. The reports lately received at the Hydrographic Office would seem to show that the general drift of the logs has been about east by south, and that most of them are now west-south-west from the Azores. Very few, if any, have drifted north of the 40th parallel. A great deal of timber has been reported farther north, to the westward of the 20th meridian, but, from the descriptions given, does not seem to be a part of the great raft.

— Dr. David T. Day of the United States Geological Survey has been requested to make a collection of American pottery for the National Museum. The collection of Sevres pottery presented by the French Government is an exceedingly fine one, as is also that of Japanese ceramics; and the department of Indian pottery is not approached elsewhere in the world. But the museum possesses very little modern American pottery, and it is now proposed to fill up this gap.

— The funeral of Prof. Roland D. Irving, late of the United States Geological Survey, took place at Tarrytown, N.Y., Saturday, June 2. Professor Irving, although only forty-one years of age, had long been connected with the survey, and had done a great amount of very valuable geological work. At the time of his death he was engaged in examining the copper-bearing rocks of the Lake Superior region, in regard to which he had published a monograph in 1883. Another monograph by him, on the 'Penokee-Gogebic Iron-Bearing Series,' has been announced. In collaboration with Mr. C. R. van Hise, he has printed a bulletin on 'Secondary Enlargement of Mineral Fragment in Certain Rocks,' and, with Mr. T. C. Chamberlin, 'Observations on the Junction between the Eastern Sandstone and the Keweenaw Series on Keweenaw Point, Lake Superior.' He had also made many contributions to the scientific journals.

— The third number of the *American Journal of Psychology* (Baltimore, Johns Hopkins University) maintains the high expectations of which the preceding numbers gave promise. There are five original memoirs touching upon several of the fields of this rapidly growing science, and the usual number of book-notices and notes. The first article is by Mr. Julius Nelson, and gives an account of his dreams in a manner that gives food for reflection. He has had the patience to record all his dreams for several years, and, as the manner of recording soon becomes regular and constant, the record can be regarded as a relative index of the amount dreamed. This he regards as the important point rather than the particular content of the dream, and his object is to find with what other physiological function this variation in the dream-quantities keeps pace. He finds it in the changes connected with the sexual function, showing a cycle (in both sexes) of a month, with coinciding maxima and minima of intensity. Mr. E. C. Sanford describes some very careful tests of the relative legibility of the small letters of the alphabet, ascertaining the order of legibility both by the distances at which they can be read and by the times it takes to read them, and deducing from his results some important reforms in the shapes of a few of the letters. As a contribution to animal psychology, Mr. Edwards tells of the habits of a colony of crows in their winter roost near Baltimore. The most astonishing point about these roosts is their size, the most modest estimates counting a quarter of a million crows. With surprising regularity they return to the roost at sunset in endless streams, and leave again early in the morning. The value of the article is increased by the full account of the literature of the topic. Dr. William Noyes contributes an interesting description of a case of paranoia expressing itself in connection with a marked artistic talent. About these artistic expressions is clustered a system of symbolism of an elaborated type. The article is well illustrated, and the case described in many respects typical. The final article is by Mr. C. F. Hodge, and gives the results of a very promising series of experiments. A group of ganglion cells were electrically stimulated for several hours, and the changes in the cells under a high power of the microscope looked for. A diminution in the size of the nucleus, measured and tabulated, is the most marked change; and the importance of the observation lies in its opening up a new field of research, from which much can be expected. Prominent among the book-notices are those on hypnotism. No less than forty-four titles occur in this review, and, though this enormous activity includes much that will not stand the test of science, it none the less indicates the scope of the subject and the interest it everywhere arouses. The other departments contain notices of articles bearing on the nervous system, on experimental, abnormal, and anthropological psychology, — all of value to specialists in these fields.

— We learn from *Nature* that some months ago a large consignment of salmon ova was despatched from Denmark to Buenos Ayres, *viâ* Hamburg, for the stocking of certain lakes and rivers in the Argentine Republic. The experiment has proved very successful, the ova arriving in excellent condition, and further consignments are to be made.

— According to *Nature* a marine zoölogical station, on the plan of the one at Naples, is shortly to be established at Ostend. The proposal is supported by four Belgian universities.

— The opening of the Transcaspian Railway to Samarcand recently is an important event in politics and an interesting one in history; but Russian writers have gone a little too far in describing it as a work of great engineering magnitude. On the contrary, with the exception of the bridge over the Oxus, according to *Engineering*, there is not a bit of hard engineering along the whole line. From one end to the other, a distance of over nine hundred miles, it traverses a more or less sandy plain, and possesses fewer engineering features of interest than a thousand other railways elsewhere on the globe. And yet, for all this, while from a technical point of view the Transcaspian Railway is a mere trifle, the undertaking, in regard to its audacious conception and successful accomplishment, must long remain a credit to Russian engineering. Eight years ago any one who would have prophesied that in the present year of grace trains would be running to Samarcand would have been considered fit for Bedlam. Universal ridicule was poured by the Russian press upon General Annenkoff when he first broached his scheme, and the English press was scarcely less complimentary to Mr. Charles Marvin when he published an account of it in his pamphlet, 'The Russian Railway to Herat and India.'

— According to *Engineering*, the Russian Government has already commenced the cutting of the Perekop Canal. This great work is intended to provide communication between the Sea of Azov and Odessa without circumnavigating the Crimea. It will be 111 versts, or 74 miles, long, and take about four and a half years to construct; its completion being timed for the autumn of 1891. When finished it will prove of considerable strategical and commercial importance. By means of it men-of-war will be able to proceed from Odessa or Otchakoff to the Sea of Azov without exposing themselves to capture in passing round the Crimean Peninsula, and a short cut will be provided for the transport of coal from the Azov port of Mariopol to the Black Sea ports of Odessa, Kherson, and Otchakoff. Both during the Crimean and the last Turkish war the Russians felt the need of rapid intercourse between the interior of Russia and the ports of the Black Sea. The new canal will enable them to concentrate their Don, Volga, and Azov resources with great facility at the Odessa extremity of the Czar's dominions, and will naturally render them more powerful in controlling the mouth of the Danube. In time of peace the canal will be of great service in allowing barges to proceed from the Don to Odessa, which at the present moment is impossible, and it is believed that there will be no difficulty in doing this even at periods when the storms that rage in the Black Sea stop coast navigation. The commencement of the canal took place without any fuss, all festivities being reserved for its completion. No engineering difficulties whatever exist.

— The average tonnage of ships passing through the Suez Canal has increased from 1,000 tons in 1871, to over 1,750 in 1887. Out of 3,137 vessels passing through last year, 2,230 were English, and only 3 American. *The Engineer* well says, "This table also indicates the depth to which the once great merchant navy of the United States has sunk, to find that only three voyages were made in the year by its ships through this great water-way."

— The annual reception of the microscopical section of the Brooklyn Microscopical Society was held June 5.

— At the last meeting of the New York Academy of Sciences, Mr. George F. Kunz exhibited some of the finest red corundum (ruby) from within twenty miles of Atlanta, Ga. This was in pieces weighing one pound, and was part of a mass weighing 350 pounds which was found on the surface. He also exhibited gold quartz from Dutch Guiana (gold formerly found there only in placer deposits had been traced to the vein by a brother of the United States consul, Mr. Thomas Brown), and exhibited specimens said to have assayed $450 to the ton. The mines are situated four miles from Paramaribo; and the ore is sent to the coast by natives, who carry it on their heads in fifty-pound bags, making two trips a day. He also read a paper entitled 'List of Diamonds found in the United States,' which will be published later on by the society, and stated, that, in addition to the diamond weighing four and a third carats, exhibited by him two months ago, and reported as having been found near Morrow Station, thirteen miles south of Atlanta, Ga., he had recently heard of a two-carat stone which was brought to Mr. L. O. Stevens of Atlanta, Ga., by a colored man, who found it in his garden a few miles from the city, but who would not sell it, or allow it to be sent North. It was imperfect and off-colored. Mr. Kunz also said that five years ago he had identified topaz, for the first time in Maine, at Stoneham; and ever since then he had been on the lookout for the rare gem phenacite, crystals of which he had the pleasure of showing on that evening. This was the first time it had ever been found in the United States outside of Colorado, where it was first discovered in 1882. In Maine a number of superb light-green and sherry-colored topaz crystals were found. They were several inches in length, but of little gem-value.

LETTERS TO THE EDITOR.

**** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

Twenty copies of the number containing his communication will be furnished free to any correspondent on request.

The editor will be glad to publish any queries consonant with the character of the journal.

An Unusual Auroral Bow.

THE description of the aurora of the night of May 20, by Mr. Kellicott of Buffalo, in *Science* of June 1, is so remarkably similar to the phenomenon as it appeared here, that it seems worthy of mention. Besides "the long streamers emanating from a bright, irregular arch resting on dark clouds," there appeared that extra arch, about the apparent width of a rainbow, with its extremities resting on the eastern and western horizons, and its top passing near the zenith. This arch was first noticed here at 9.30 P.M. standard time, and was very bright at that time, but without color. After 9.35 P.M. it began to grow fainter, but was still faintly visible at 10 P.M. A phenomenon visible here which was not mentioned by Mr. Kellicott was the appearance of a segment of a secondary arch or band attached to the top of the main arch in the north, and at 9.30 P.M. extending down to the horizon a little west of north. Between 9.35 P.M. and 9.40 P.M. the lower end of this segment seemed to detach itself from the earth, and, pulsating like a piece of ribbon held by one hand and waving in the wind, it rose upward, at the same time exhibiting beautiful colors, and at 9.40 to 9.42 P.M. joined the main arch, which assumed the appearance of a bent bow. The main arch retained this appearance for nearly a half-hour, but slowly assumed the appearance of the normal auroral bow without streamers. The times and appearances given above were taken from notes made at the time of the aurora.

H. HELM CLAYTON.

Blue Hill Observatory, June 5.

The People and the Common Schools.

HOW natural it is for us to try to shift responsibility from our own shoulders upon some other fellow's back! and yet, as Lester Wallack used to say in 'Ours,' "there is nothing so consoling to a man, when he is found out, as the sweet consciousness of — guilt."

The people are at last becoming conscious that there is something wrong in the great public-school system of New York City, — a fact that has been evident to every true educator in the land for the past ten years; and now the people dearly desire to make somebody a scapegoat for their sins. After stoning the scapegoat out of camp and into the wilderness, they would like to again relapse into a complacent contemplation of their own righteousness, soothed by a serene sense of duty well done.

They can safely enjoy "the sweet consciousness of guilt," however. The schools are to-day just what the people, through apathy, indifference, carelessness, and ignorance, have permitted them to become, — one vast machine; a treadmill, teachers treading the wheel, happy innocent children the grist, superintendents for taskmasters, and the product a mass of automatons.

Have you not committed the monumental stupidity of placing, through laws enacted by your servants, all responsibility for the management of your schools — not only in monetary matters, but in all educational affairs as well — into the hands of bankers, brokers, lawyers, and physicians, who know no more about the science of education than school-teachers do about finance, law, and medicine, and perhaps not half as much?

To show the utter absurdity of this condition of affairs, it is only necessary to suggest that the Chamber of Commerce, the Stock Exchange, the Bar Association, and the County Medical Society select their governing committees from among the principals of the New York schools. Preposterous, is it? Would it not be safer to intrust affairs of finance to a man who knows, in theory at least, all the laws that govern trade — as a principal must — than to intrust the education of one hundred and fifty thousand children to men who know nothing of the science of pedagogy even in theory?

It is of no use to try to dodge the issue by stating that the Board of Education is guided in educational matters by the city superintendent, an expert teacher. Neither he nor the Board of Education will permit any such construction of the law defining their relative positions. The city superintendent pleads that he is only responsible for the execution of the law as it stands. The Board of Education assumes all responsibility for the inception, enactment, and continuance of all the laws, other than 'State Statutes,' which he executes.

The city superintendent is thus the self-confessed creature of the system he administers, instead of being, as you perhaps supposed, in any degree its creator. If he is not even the author of any portion of the present system, of which he has been the executive head for the past nine years, how can he be expected to become the creator of a nobler plan for the education of your children? You certainly cannot indulge in any such unreasonable expectation.

You, the people of New York City, are directly responsible for the larger part of all the evils that exist in the common-school system. Your children attend them; you hear from them daily reports of the manner in which they are educationally crammed; you see them at home, wearing out their young lives in preparing lessons for the next day's recitations; and, if some wise teacher reduces the tasks assigned for home-study, you immediately begin to inquire why your children have no more books, and why they have so few lessons to learn at home.

I know you do this, for I have heard you talk just that way. In vain have I pleaded with you for the little ones. In vain have I told you that five hours' daily attention to books, to recitations, to instruction, is all that any growing child can safely endure. "No, no!" you cry, "give them more lessons — give them tasks to do at home;" and your children go through their school-lives with the shadow of the coming task always falling upon the task just finished. The gentle, obedient, loving, and affectionate little ones suffer; while the dear bad boys won't even make an effort, and thrive accordingly. The teacher can sometimes go home with his work finished for the day; the pupil never.

Now, if I will not permit this wrong to be perpetrated in the school under my charge, you take your boy away and send him to Mr. Examination Hunter's school; and you take your girl out of Miss Honest's department and send her down to Miss Show-off's school; and then you point with parental pride to the great load of books your little ones stagger under, as a proof of the superior efficiency of those two principals "whom we all respect." Then, when your little girl graduates, and Miss Show-off orders all the graduates to wear white dresses and tea-roses, and to come in carriages, and to drape their desks in white, you all say, "She has no right to give any such orders, and it ought to be stopped, and" — You get the dresses and the tea-roses and the carriage, and you attend the reception; and it is all so beautiful, and the members of the mutual admiration society do speak so mellifluently, — buttered honey, as it were, — that you are as proud of your daughter as a drum-major on parade. And then you go home, and your daughter has typhoid-fever, or spinal meningitis, or some other Latin disease, and you lay the blame on Providence. Who is to blame if the supply of sham education be exactly proportioned to your demand for it?

If you could only once be roused from your apathy on this subject, do you not know that your servants — the mayor, the Board of Education, and the Legislature of this great State of New York — would skip around like waiters in a dime restaurant to get you what you want?

The press has at last taken hold of this matter for you. How many of you will read what is written in your interest, and how many more will skip it all in order to read about the latest base-ball match or the last prize-fight? If you, happily, by any chance, have read thus far without throwing down the paper, will you kindly read the summing-up of the whole matter? The public schools of New York City will never be any better than the people of that city demand that they shall be.

EDWARD H. BOYER,
Principal Grammar School 9.

Reflex Speech.

NOTING the paragraph in *Science* of May 25, quoting from the *Journal of Mental Science* a statement of experiments in reflex speech, it seemed to me that certain experiences of my own in reflex writing might be of interest. I compose and write with considerable rapidity, and, on re-reading my manuscript, often find that my hand has written words in opposition to the orders from my mind. Of the several words beginning with *th*, for instance, 'the' is often written where 'they,' 'this,' or some other word, was intended. In like manner 'their' becomes 'there;' 'whether' takes the form of 'where;' 'while' replaces 'which,' 'what,' etc.; and other vagaries of the same general character now and then appear. Probably experiences of this kind are common, and are passed over without reflection as to their cause. They have long seemed to me evidences of reflex action. In rapid composition, the writing hand lags behind the conscious thought, which springs on to the words in advance, and leaves its successive orders to be executed in an automatic and unconscious fashion.

Ordinarily the wheels of the brain roll on in due order; but occasionally the hand seems to take the task of suggestion on itself, taking advantage of the absence of consciousness, and moving in a more customary channel than that directed: *th*, for instance, is followed by *e* more commonly than by any other letters; and the hand, if left to the action of reflex suggestion, would write 'the' in preference to the other *th* words. It is not at all surprising, then, that the writing of *th* sends back a reflex suggestion of *e* as the concluding letter of the word, which is occasionally of sufficient strength to overcome the impulse given by consciousness to the brain to write some other word.

It may be, however, that this phenomenon is due to relations of the nervous system different from those ordinarily estimated, and that the brain has nothing to do with the dereliction of duty in the hand. I should suggest the following theory in explanation of the phenomenon. The brain does not differ in physical formation from the inferior ganglia, and may not differ in its power of memory-recording. The impulses which pass along the sensory nerves to the brain traverse several ganglia on their way thither, and may leave memory traces in each of these as well as in the brain. The impulses to motion emanating from the brain similarly pass through inferior ganglia, and may produce in them conditions similar to those affecting the brain at that instant. But when the consciousness has brought the brain into condition to produce certain successive effects, this condition does not exist in the inferior ganglia. In writing the letters *th*, for instance, two influences are at work. There are influences descending from the brain to produce certain succeeding motions in the fingers; and there are sensory influences flowing upward from the moving fingers which are full of reflex suggestiveness. It seems not improbable, then, that this reflex suggestion may now and then call forth a response from an inferior ganglion, and thus check the action of the brain, which, in its unconscious automatism, may need a reflex influence from the fingers to bring it into condition to complete the word.

If such be the case, we can readily understand why the more ordinary words beginning with certain letters are occasionally written, instead of those dictated by consciousness, which begin with the same letters. It may perhaps be that the work in both cases is done by the brain, and yet this hardly seems probable: for the brain is put in train to perform a certain duty, and its tendency to do this seems likely to be stronger than any reverse tendency to perform a more customary action. This reverse tendency may undoubtedly occasionally gain precedence; but, if the inferior ganglia have the capabilities above suggested, it is not improbable that the reversing influence comes from them, and that the precedence which the brain possesses while in conscious activity may weaken during unconsciousness, so that, if the reflex influence from the hand arouses all the ganglia through which it passes to activity, an inferior ganglion may occasionally win in the conflict with the brain, and take control of the reins of action. C. MORRIS.

Philadelphia, Penn., June 5.

Answers.

32. HUMAN BEINGS AS PACK-ANIMALS. — Prof. Joseph LeConte of the University of California sends the following information in reply to an inquiry in *Science* in reference to the strength and endurance of the human pack-animal. I shall be extremely obliged for many notes of this kind from every part of the world. "In 1844 I travelled by birch-bark canoe something like a thousand miles, from Lapoint over to the head waters of the Mississippi, and down the latter to Fort Snelling, at mouth of Minnesota River. We made several portages, the longest being nine miles. We had along two trunks, and provisions and bedding for four persons for one month. The load which our two *voyageurs* carried was certainly one hundred and fifty to two hundred pounds each. They made seven miles in one day, going over the ground five times; i.e., thirty-five miles. Three fifths of the distance they were loaded, and two fifths going back for another load. Their plan was to take the heaviest load first (about two hundred pounds), and carry it about a mile or a mile and a half, put it down, go back for another load of one hundred and fifty pounds, carry this a mile or a mile and a half beyond the first deposit, then come back, take up the first deposit and carry it the same distance beyond, etc., until all was carried to the camp for the night; then, last of all, they went back seven miles to the last camp, took up the boat (which was the lightest load of all), and carried it to camp. I will give an account of one load. They used a leather strap about two inches and a half wide in middle, and slenderer towards the end, and perhaps ten or twelve feet long. One fellow, a famous *voyageur*, would tie this about my trunk (about seventy-five pounds) in two places near each end, and throw it over the head, bringing the band across the forehead, the trunk resting on the back, then take a hundred pounds of flour and put on the trunk, and then twenty-five pounds of crackers on top of all, and walk off briskly, almost in a trot. The man was not a large or very muscular man, but rather lean and wiry."

O. T. MASON.

Washington, D.C., June 5.

SCIENCE

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SCIENCE

FRIDAY, JUNE 22, 1888.

A WRITER TO the Contributors' Club of the July *Atlantic* rightly says that much time and thought are spent in selecting a name for a play or novel, for it is known that success is largely dependent on it, but that parents are strangely careless and unscientific in giving names to children. In the Harvard and Yale catalogues of last year the contributor finds but two or three combinations really good in his opinion. Usually, when a new-comer arrives, some old family name is taken; or, if the parents exercise an original choice, they are too much excited to be guided by any sound euphonic principles. They forget that not only from the social point of view it is very advantageous to have one's name remembered, but that from the business point of view notoriety is capital, and must be obtained by persistent and ingenious advertising. But if a certain amount of notoriety could be obtained for John Smith by an expenditure of time, money, and ingenuity represented by x, and spread over a period of three years, the *Atlantic* writer thinks it safe to say that the same amount could be obtained for Hans Arrowsmith by $\frac{x}{4}$ in eighteen months. Nor does he think the saving of time and money on the part of the knocker at the gate of notoriety the only thing to be considered. The economy of the public stock of energy wasted in innumerable unconscious efforts to remember a name without any corners for the memory to grasp, but persistently thrust before it, would result in an increase of available mental force applicable to settling the question of future probation, or to raising the ethical standard, or to reforming the tariff, or to disposing of the surplus. The importance of the subject leads to the suggestion of one or two of what we believe to be the chief fundamental principles of the science of naming children. The system is simple, and any provident parent can easily master and apply it. 1. Avoid odd, or eccentric, or poetic combinations, and be guided by euphonic quality only. It is true that an odd name may be remembered, but the associations with it will not be pleasing. The idea of oddity or affectation may attach to the shadowy personality built up in the mind of the public. Under this rule, hyphenated names, especially hyphenated Christian names, like Floyd-Jones Robinson, are to be avoided. Writing the first given name with an initial and the second in full is also evidently opposed to correct scientific principles. 2. The best form of a name is a dactyl and a spondee, like 'Jeremy Taylor.' Every one has heard of the 'Shakspeare of divines,' and has a dim idea of an agreeable personality attached to the name. Had his name been Charles Taylor, it is far within bounds to say that his reputation would be about one-third of what it is now. 3. If the surname is not one that can be treated according to the above rule, it should be fitted with a given name, such as to bring the combination as nearly as possible to the above length and cadence, as, Sidney Dobell, Ellery Vane, Henry Ward Beecher, Dante Rossetti, Theodore Watts, and the like; or, otherwise, to two long syllables, like Mark Twain or Bret Harte. The subdivisions of this branch of the subject are too numerous to be given, but all rest on principle No. 2. The phonic value of the surname is, under our custom, the controlling element in practically applying the science of names. The great value of names beginning with 'Mac' or 'O' is evident, because they so readily combine with the ordinary Christian names. A boy pervades the *Atlantic* writer's quiet neighborhood simply because his name is Johnny MacWhorter. He is not in any respect a remarkable boy, but his name forces him into prominence by its phonic value. There are some ten or twelve boys who are comrades, but he and another dactyl-spondee boy, Emory Watson, are the only ones ever spoken of. No doubt there are others who do as much mischief and make more noise, but these two reap all the fame.

THE BILL CREATING a department of agriculture has been recommitted in the Senate, the object of those who voted this disposition of it being to have restored the section, which had been stricken out, transferring the Weather Bureau to the proposed new department. What the final vote upon this question will be is still in doubt, as is also its wisdom. The Weather Bureau has become a necessity to the people of the United States, who will cheerfully pay the million dollars that it annually costs, but who will insist, that, if any change in the service is made, it shall be certain to bring about an improvement, and not a deterioration. The provision of the section in question that gives to all present officers of the Signal Service who shall be transferred to the proposed new department a perpetual tenure of office, at their present pay, making no provision for weeding out the worthless men or advancing the competent ones, is certainly not calculated to make the service any better. It would probably result in the permanent retention of the incompetent, dissipated men in the Weather Bureau; while the bright men, who would be really useful in the bureau, would prefer other positions, where they might be promoted as they deserved.

The observations upon which the Weather Bureau bases its calculations are now all made by enlisted men of the army, who have been specially instructed and trained for the work. No political influence whatever has been allowed to operate for their appointment, promotion, or retention in the service. It has been the aim of the chief of the Signal Office to send to all important stations men who will be acceptable to the communities in which they are to live and do their work, but no member of Congress has been able to secure the transfer or removal of an observer sergeant in order that some favorite might be put in his place. The security which the observer sergeants have felt for the terms of their enlistment has certainly had a beneficial effect upon the character of the service they have rendered. It may seem an anomaly to the people that a duty that is in no respect of a military character should be done by soldiers rather than by civilians, but the military organization of the Weather Bureau has certainly resulted in keeping political influence from dictating in regard to the *personnel* of a class of men whose appointment and promotion it was very desirable to keep free from this influence.

A straw was in the wind the other day which shows the direction it has already taken in anticipation of the change. Mr. Hatch, member of Congress from Missouri, and chairman of the Committee on Agriculture, recently recommended that a certain private in the Signal Service be made a lieutenant, and the entire Missouri delegation joined in the request. When the matter was referred to General Greely, he replied that the promotion could not be made. In the first place, it would be illegal to appoint the man to be a lieutenant unless he was already a sergeant, and he could not be made a sergeant because he was incompetent for the duties of that office. If the man had been a civil officer, or the bureau had been attached to a civil department, he would probably have secured his promotion. A new plan to transform the Weather Bureau from a military to a civil one was disclosed in the sundry civil appropriation bill reported in the House last Saturday. It provides for the appointment of a civil force of 111 persons in the office of the Chief Signal Officer, with an aggregate compensation of $114,500 a year, and this force it is proposed to substitute for the present military one of 150 men, and so save an expense of $70,748 a year.

THE EFFICIENCY OF MECHANICAL ENGINEERING SCHOOLS.[1]

WHEN the alumni of a school of engineering meet in annual reunion and conference, it is but natural to select for discussion a subject the serious deliberation of which will, to some extent at least, advance alike the interests of engineering practice and of the technical school itself. The technical graduate, who loves his profession and his alma mater, must deem it a wish of his heart to further in every way the harmony between the training and the practice of the engineer, to raise the efficiency of both the practice and the school to the highest attainable standard.

Happily, it is a fact that each day the value and importance of the technical school are becoming better appreciated, and that at this time none are readier to acknowledge the benefits conferred by systematic training in such schools than the leading engineers, who, without such preparation, have by their individual, unaided efforts, risen to deserved prominence and fame. Such general appreciation is recognized in the spoken and written word of the foremost men in the profession, in the fact that they send their sons and advise young men seeking to become mechanical engineers to attend these schools, and in the marked preference shown in the employment of the technically trained engineers. That these are facts is a cause for congratulation, a testimony to the value of systematic study, and an evidence of at least an average efficiency on the part of the leading schools of mechanical engineering. It is a great advance upon the time, not so long ago, when it was presumed that the main thing — and the first thing — the technical graduate had to do was to unlearn almost every thing he had acquired in the schools.

While we should be duly grateful that the status at the present day is such as we have pictured it, we must not conclude hastily that the technical school is fulfilling its entire mission, or, if I may so term it, attaining an efficiency of one. I am well aware that this would be asking too much; for what device, scheme, or appliance can show up this efficiency? At the same time the technical school should approach this limiting value of the perfect device as nearly as possible, and we should study the sources of loss, so as to reduce the losses to a minimum.

Such is naturally the main object of the serious work of alumni meetings, and the president's address should at least serve as an incentive to direct special thought on the part of the membership to these particulars.

From this point of view, the inquiry has suggested itself to me as worthy of our consideration, has the instruction in schools of mechanical engineering, within the past twelve years, progressed so as to conform to the increasing needs called for by the engineering advances secured within the same time?

In a paper read last month before the American Society of Mechanical Engineers, one of the members, who has practically contributed to the progress of the printing-press, presents 'A Plea for the Printing-Press in Mechanical Engineering Schools.' It is an honest plea, courteously uttered, and with an evident desire in no way to disparage the value of the training secured in engineering schools. The writer maintains, that while the printing-press shares, perhaps, alike with the steam-engine the fame as a great civilizer, no attention is given to it in any specific way in the leading engineering schools; that no books relating to it are studied or referred to, no lectures delivered detailing its mechanism; that its factories are not inspected by the students; and that no sample machines adorn the schools' laboratories of engineering. All this is inferred by the writer from a perusal of the catalogues. Usually, judgment as to the course of studies pursued, if based solely on the catalogues themselves, is a dangerous procedure, apt to lead to fatal errors; but in this case no mistake is made, for it is a fact that the printing-press receives but little if any attention in the engineering schools.

Had our friend, the writer, been interested to draw the picture of neglect of subjects discussed still further, he would have soon discovered that small attention, if any, is paid in the course pursued in engineering schools to type setting and distributing machines, paper-making machinery, envelope-machines, sewing and stitching machines, which are allied closely with the printing-press as civilizing agents. And if he looked over the many practical industrial engineering fields, he would have had to come to the conclusion, that, as a whole, but little if any attention is paid to hat-making, cloth-finishing, brick-making, and agricultural machinery, and the like, and that even the looms of various nature come in for the most cursory attention.

Had this been done, the amount of neglect discovered would have been so appalling that he would logically have been forced to one of two conclusions, — either that his point of view and solution were not the proper ones; or that mechanical engineering schools are essentially a failure, and not in one whit entitled to the credit which he really liberally bestows, when having but the one practical omission in mind, and not the many others, no less important ones, only a few of which we have enumerated.

Had the latter conclusion, condemning the schools as a failure, been reached, it would, in my judgment, have been a totally erroneous one.

Still the fact remains that within the past twelve years (and I only name this period because it is the term in which, since graduating from Stevens, I have followed more closely and played my humble part in the current of events) the progress made in most of the individual engineering and mechanical pursuits has been tremendous, while entirely new industries have called for new engineering appliances, and, *vice versa*, new inventions have developed new industries.

What should be the relation of the course of study pursued in the schools of mechanical engineering to these ever-increasing important industrial engineering applications?

Should every new, important mechanical device, especially if it brings with it new fields of practical employment and labor for the engineer, immediately find its place as a study in the engineering school?

If this be so, the school of mechanical engineering will have to extend its term of study to an indefinite extent; and ere long it will come to pass that the young student, entering as a beardless youth, will graduate from the school as a gray-haired man in the decline of life: for, surely, if every important machine is to be the subject of special study in the technical school, a lifetime will only suffice to cover the ground. And the result?

The result would be that the engineering schools would be of no use to the world; for the world's engineering work would be being done by outsiders, while the gray-haired students, plodding along, would be kept busy studying this very work, and not be active agents in its development.

I have purposely drawn this picture from an extreme point of view, for such method often enables us to discover what the fundamental truth underlying the problem really is. I think, in this case, the truth is apparent at once.

It is the mission of the technical school to inculcate the principles of engineering, to train and mature the powers of observation and mechanical judgment, and, after teaching the laws of physics and mechanics, to give the ability to apply these laws to problems arising in machinery and the industrial arts. The special machines and appliances dwelt upon in the school should serve this one purpose: a knowledge of them should not be the end, but the means. Because we can best inculcate and supplement a correct understanding of the physical laws, and a knowledge of how to apply them to the design of machinery, by studying the successful applications made, therefore such study should form an important factor in the course of the technical school.

These engines, motors, machines, factories, and engineering works should serve as the constant tests and checks of the student's efforts at individual design. When the student has once acquired the ability to put physical principles and experimental data

[1] Presidential address delivered by Alfred R. Wolff, M.E., before the Alumni Association of the Stevens Institute of Technology, June 13, 1888.

into the best engineering forms, bearing in mind economy of material, with least sacrifice of strength, best method of handling, management, and the like, he comes equipped to struggle with new machines of which he has had no previous special knowledge. The school cannot give to the student all this desirable latent power, or stored energy, for much of it must come in later life from individual, unaided effort; and the experiences of daily application (often coupled with some degree of failure) must be the teachers which never leave the side of the devotee of engineering science. But these teachers are most efficient, if the student has been trained in the engineering school both and ever to reason before beginning work, and to check his previous reasoning by the results secured.

If we regard the technical school from this aspect, it is plain why the various prime movers play so important an element in the course of instruction, to the disadvantage of other possibly equally important machines.

They are the most direct applications of very important and leading laws of physics; and the intelligent discussion of the prime movers calls for quite a knowledge of these laws, both in experimental and mathematical form. The problems of mechanics are splendidly embodied in the design of the various parts, and in many diverse ways, modified as is the application by the strains to which the parts are submitted, the strength of the materials, and the practical methods of their working. Every conceivable strain, simple and compound, since it enters the working of the steam-engine, for instance, comes up for consideration, while all the leading materials enter its construction. The prime movers act as fine checks on the student's individual efforts at design, for they represent the embodiment of centuries of application and development by the best engineering talent. They give opportunity for experimental verification of the laws of physics and mechanics as well.

In other words, I maintain that the main reason why the prime movers play so important a factor, and occupy so leading a part, in the course of study of a technical school, is not directly because they are such great civilizing agents and have so wide an application, but because they serve, as above indicated, as the best method of study for the incipient engineer. I do not think that the latter point has been sufficiently analyzed, emphasized, and made clear, certain as I am that you will agree with me as to its importance and truth.

And it is for the same reason that other far-reaching machinery, such as I have mentioned, great as is its use, and important as is its development, can have but little time devoted to its study in the technical school. It is because, as engineering exercises, these machines do not equal the prime movers; and saving of time commands that the best exercises be adopted. If the prime movers were far less important industrial factors than they really are, their study would, in a well-regulated course of engineering, which is planned not as an advertising medium, but is based on the principle of serving the student best, be just as important a matter and as conspicuous as is the case to-day. I think the point of view that the machinery discussed in the schools should be the educational means, should be the exercises adopted for testing and furthering a knowledge of the laws of physics and mechanics, as embodied in design, is an efficient answer to much of the criticism of the class to which we have referred.

If it be insisted on, that the reason so much time is devoted to the prime movers (notably steam-engines) is because of their general application in all industries, I will admit that this may have been the cause why originally they were put down for so much attention. Had it then, however, not been shown that they serve as well as the best exercises in the application of the laws of physics, mechanics, and design, they could not have held their place, and would, long ere this, have had to give way to the study of other devices of less wide application which answered the educational need better.

I fully appreciate the view that it is commendable, indeed desirable, that the students, when graduating from technical schools, should possess some general knowledge of the leading machines in the market; but the first essential thing is, that they should have acquired the ability to be useful workers in every field by being possessed of a knowledge of the principles and methods of procedure which underlies all engineering works and machines and their design.

At the same time let us not be slow to learn all we can from criticism honestly advanced; and so, while I do not deem it an essential matter, I say (cost, room, and time permitting) it were well, perhaps, if some few important machines, now totally neglected, could find some place as types in the engineering laboratories, and receive some brief attention by visits to the factories, or, in some cases, by evening lectures delivered by specialists. To a limited extent this might prove, it appears to me, a proper field for non-resident lectureships. It is indeed a question whether such lectures on special machines not at all studied in the school, delivered by acknowledged experts, would not prove more useful than the growing practice of having matters that are gone over in detail in the regular course reviewed hastily in brief discourse by leading engineers. In the nature of things, these outsiders are apt to be at sea in point of exact information as to the extent of preparation and acquisition of their hearers, the students, in the special subject under discussion, and thus are led to indulge in the dispensation of elementary information or fruitless generalities, which add little or nothing to the students' knowledge or ability.

But, before even this special lecture course is undertaken, we should make sure that any time which can be gained cannot be more advantageously employed in a more thorough course of the prime movers themselves; for to-day it is a common experience and regret, on the part of professors of engineering, that they cannot find in the crowded curriculum much needed leisure to devote to some important educational problems in design and applied engineering which these prime movers offer.

The general view that time is an important factor, that the best attainable must be accomplished within a given time, and those exercises be adopted which will serve as the best means of furthering a knowledge of the principles in their engineering aspect, and, furthermore, the desirability to embrace every thing of real importance in the course, makes it a vital matter to constantly scrutinize and keep close watch on the course pursued, in the hope of discovering whether some matters studied might not be omitted or advantageously modified, so as to give spare time to the essential.

Regarding it from this aspect, it has occurred to me that some of the theoretical preparatory studies pursued, such as mathematics, physics, chemistry, and the like, — and I purposely omit languages, belles-lettres, and those general academic branches having a less intimate connection with the engineering course, — seem not to be carried out in some particulars so as to secure the highest efficiency from an engineering point of view.

Let me call your attention to this point. Is it not remarkable that essentially the same text-books on physics, chemistry, analytical mathematics, descriptive geometry, and the like, are studied at engineering schools as at the ordinary academic course of a university? Does not this fact of itself almost imply that the studies, as pursued, are not made to specially adapt themselves to the needs of the applied studies of the engineer? Could not some abstract developments, now dwelt upon at length, be advantageously omitted, while physical experiments and applications in heat, electricity, and the like, be more copiously introduced as exercises, both with the view of imparting a thorough hold on the abstract taught, and also as imparting requisite useful information and methods of procedure? It is my opinion, that, in the application of mathematics to physical problems, even the mathematician, and certainly the engineer, can best test and master a knowledge of the mathematics themselves.

How common is the experience of those who, having acquired in the usual way, even from the best of masters, what they considered a pretty fair hold on calculus, — and this embraces the experience of many gifted students, — when they tried to apply this knowledge in the study of the mechanical theory of heat, found they really had no thorough grip on the calculus, as they had presumed, and had, in fact, to start anew, with a decided loss of time, which might, it seems to me, have been avoided!

I concede the value as fully, and am as anxious as any one to guard the pursuit of knowledge in the abstract on its own account. Still, I say, why not in plane, solid, descriptive, and analytical geometry, and in calculus and other analytical mathematics, gain some time now devoted to the elucidation of abstract propositions, and detailed elaborations in various forms of the same propositions, of no direct value, and some time now devoted to applications, which, designed to test the understanding, are really essentially numerical substitutions, so as to find leisure to supply physical problems as a test? The latter problems best serve to call forth a true knowledge of the principles. It is only in such application that we discover whether we have really grasped and actually secured the full meaning of the principle. So, too, in the course of physics as pursued in mechanical engineering schools, some details now studied, from force of habit and as being the regular thing in a complete course of physics, might, it appears to me, be advantageously omitted, and replaced by special and more extended work in heat, electricity, elasticity, and the like.

Surely, I trust, this will not be misinterpreted as a plea for the abandonment of study of abstract principles. The abstract principle is to be thoroughly studied, and the application is designed to insure the full comprehension of the principle. But why not select as far as possible, and dwell mainly on, such abstract principles, which can be re-enforced by these physical tests, and select such practical physical exercises, experience in which will re-act alike most directly to the comprehension of the abstract, and as desirable preparatory knowledge for the engineering course?

This is the only solution, if a four-years' course is to suffice; and, furthermore, it is in direct accord with the principle which underlies the engineering instruction, and which permits us to pay little attention to many fine important engineering devices, such as the printing-presses, agricultural machinery, and the like.

You will readily appreciate that this insertion of proper exercises, this working-out of special text-books and courses of study in the various elementary sciences, forming the foundation and most of the first two years' course of the mechanical engineer, applies to the several branches taught. I cannot burden this already too long address with details in the several departments; but there is, it appears to me, no great difficulty in discovering them when careful search is made.

If the point here emphasized would be borne in mind more steadfastly than is now the case, I believe time could be saved in the two later years, when the deficiency outlined must be then supplied as best it can, and some further exercises bearing on useful applications in design, and special lectures now crowded out, could find room.

If I have dwelt on the time available as an important factor in the educational problem, it is not to be interpreted as a favoring of undue haste. Better acquire some things thoroughly than a greater number superficially, for only in thorough acquirement can habits of correct observation and matured judgment be formed.

If I pointed out that in the two years' preparatory work of the course in an engineering school the general scheme seems to me, as far as I have been able to follow the matter, to be essentially the same during the past twelve years, while the fact of the rapid developments in applied engineering does make it important to consider some matters, at least from a general point of view, not necessary to consider at all twelve years ago, it is not to be construed as a sweeping criticism of this preparatory course. Such course is in my opinion, on the whole, admirable, but I believe it could be improved in the particular named. At the same time I am aware that a practising engineer, who only gives thought to these educational matters now and then, is apt to underrate the progress made; which progress may, in fact, be much greater than he anticipates, and perhaps even in the very line of the criticism advanced. If it be thus, so much the better that these words be uttered at the alumni meeting of the leading school of mechanical engineering in the country, where the presence of the faculty and their participation in the discussion will speedily lead to rectification of the error, if such it be, and to the enlightenment of those graduates and others who share the views just set forth.

In closing, let me emphasize that what I have said is meant to apply not specifically to our own alma mater, but to mechanical engineering schools in general.

THE conferring of degrees at the close of the twelfth academic year of the Johns Hopkins University took place June 14.

THE ETHNIC POSITION OF THE BASQUE NATION.

THE Basque or Euskarian people of the Pyrenæan and Cantabrian ridge are supposed to count at present about six hundred thousand souls. Four-fifths of them live on Spanish territory. They are well-proportioned in their bodies, but rather small, so that a large percentage have to be excluded from military service. Most of them are of a dark-brown complexion, although blondes are not scarce. Their faces are oval, their features agreeable, their general health excellent; and "to run like a Basque" has become a proverbial locution throughout the south-west of Europe. Among the Spanish Basques the dolichocephalic type is almost the only one observed. These and other ethnologic points form the introductory to a learned article by Prof. G. Gerland, 'The Basques and the Iberians,' inserted in the first volume of G. Gröber's 'Grundriss der romanischen Philologie,' one of the best encyclopedic works that ever appeared on the Romance languages of southern Europe (1886, pp. 313–334). The peculiar social and legal customs of the Basques, our author continues, make of them a people with archaistic survivals of various kinds, but do not by any means prove them to be an ethnologically isolated race. But their peculiar language shows them to be distinct from any other nationality. Some said that the 'Vascuence' was the language spoken in Paradise, while others believed "that even the Devil could not acquire this tongue." The sound *f* is wanting in all its dialects, and the language belongs to the agglutinative type. The radices are all monosyllables, or reducible to such, verbal roots being made clearly distinct from nominal roots. Basque is a pure suffix language, prefixes being unknown: even the definite article 'a' is postpositive. The language is not sex-denoting, except in the pronoun. The inflection of the transitive verb differs from that of the intransitive, but in both is mainly carried on by auxiliary verbs. The large number of verbal conjugations established by the earlier grammarians chiefly rest on the various direct and indirect pronominal objects that may become connected with the verb.

All these distinguishing traits of the language separate the Basque from the Celts as well as from the Romans; but whether they separated them also from the old Iberians is the problem which Gerland (and so many others before him) has tried to solve. The reports of the ancients upon the popular customs of the Iberians wholly coincide with what we know of the Basques of to-day; but a much more stringent proof lies in the fact that the ancient local names of the largest portion of Hispania, then inhabited by the Iberians, can be explained through the Basque language only. This region of Basque local names also extended over Aquitania in south-western France; and it is a striking fact in favor of this theory, that the present Gasconian dialect does not know the sounds *f* and *v*, for the Gascons are nothing else but Romanized Basques, and the tribal name of the ancient Ausci in those parts is the radix of the name 'Euskarian.'

That the Iberians, or ancient Basques as we may call them with Gerland, formed a unit as to their language and ethnic peculiarities, is evidenced by the fact that the Spanish language was evolved in homogeneous, uniform manner throughout the peninsula, whereas in France and Italy the ethnic difference of the inhabitants has produced dialects in the north and south which are opposed to each other, just as so many different languages. Although an immigration of Celts about 530 B.C. produced a race called Celtiberians, the manners and customs have remained Iberian with small modifications, and the dialectic differences among these were probably inconsiderable. Among the Iberian features which have impressed themselves upon the Spanish people, Gerland counts the bigotry and fanaticism of the Church, and the fondness for audacious, adventurous maritine expeditions.

While enumerating Basque terms which have found their way into the Spanish literary language, Gerland very pertinently remarks that barely one-third of these is found in the Portuguese, but that several had entered into the Hispano-Roman dialect at the time of the Roman domination. The Latin tongue has undergone less alterations in the Spanish language than in any other of the Romance languages of modern times. This is explained by Gerland by the fact that the Basque then spoken in the country was too heterogeneous for having much influence on the phonetics and morphology of the new language then in course of formation. The late Prof. Fr. Dïez was of different opinion. He thought that Italian was that Romance language which formed the nearest approach to Old Latin. But there is no doubt that Spanish and Portuguese show considerable repugnance against the sound *f*, and that the double pronunciation of *r* in Spanish and Portuguese is identical with the one we find in Basque. Gerland also proposes the query, whether the softened *l*, *ñ*, *n*, so frequent in Basque, have caused the softening of *l* and *n* into *ll* and *ñ* of Spanish as well as of Portuguese, or whether this must be ascribed to other causes.

THE GREAT MARCH BLIZZARD.

THE great storm off the Atlantic coast of the United States of March 11–14 will probably go into history as the most severe experienced since this country has been inhabited by Europeans. Not only was it remarkable for its force and duration, but also for the unexpected manner of its appearance and development, and for the track it followed from the time it was first observed to that of its final disappearance.

No previous great storm at sea has been as thoroughly studied from such abundance of data as this very fortunately has been. From the time that the first vessel arrived in port which had encountered the storm at sea, to the present, the Hydrographic Office of the Navy Department has been collecting, arranging, and comparing all the reports in regard to it that have been received, and will soon publish a monograph giving a history of the great disturbance, illustrated by a number of carefully prepared maps and charts. Mr. Everett Hayden, who has had charge of the work, in a paper recently read before the National Geographic Society, gave the substance of what this monograph will contain. The following is an abstract of his paper.

Mr. Hayden began by referring briefly to the difficulties and delays that necessarily attend the collection of data by which to study the character and progress of a great ocean-storm, and illustrated these by stating the fact that a ship which recently arrived at New York from Calcutta supplied very valuable facts regarding one of the great hurricanes of August last, from a region to the westward of the Cape Verde Islands, where data were especially needed.

Four large colored charts were used to illustrate the meteorological conditions over the area charted (latitude 25° to 5° north, longitude 50° to 85° west) at 7 A.M., 75th meridian time, March 11, 12, 13, and 14 respectively. These charts contained isobars for each tenth of an inch, reduced pressure, and isotherms for each 10° F.; temperatures above freezing, in a tint of varying intensity of red; and below freezing, of blue. A large track-chart with vessels' positions and tracks enabled the audience more clearly to follow the discussion and the storm-reports which were quoted. A barometer diagram illustrated the fluctuations of the barometer at six land-stations and on board six vessels, selected with special reference to the completeness of their data, and their position relative to the storm. Diagrams were prepared, also, to show the varying height of the barometer along north-and-south sections, selected to emphasize the fact that the special feature of the storm was its trough-like form, the isobars about the area of low barometer being elliptical in shape, along a north-and-south line, and moving eastward between two ridges of high barometer.

The synchronous weather-charts were discussed successively. The first, that for 7 A.M., March 11, showed a trough of low barometer reaching from the Gulf far northward, past the eastern shore of Lake Huron, toward the southern limits of Hudson Bay. Off the coast a ridge of high barometer stretched down from the Gulf of St. Lawrence toward Santo Domingo, passing about midway between the Bermudas and Cape Hatteras. To the westward another ridge of high barometer extended from Dakota to below the Rio Grande. Along the coast the prevailing winds were therefore easterly and south-westerly; the warm, moist air drawn up from down within the tropics causing a warm wave, with generally cloudy weather and rain. In rear of the line of low barometer, a cold, north-westerly wind was blowing, carrying a cold wave far down into the Gulf, with frosts as far south as Louisiana and Mississippi, and cool northerly winds clear down to Vera Cruz.

Before considering the next chart, a description was given of the meteorological conditions off the coast, awaiting the advance of this long line of cold north-westerly gales, which was moving eastward at the rate of about six hundred miles a day. Attention was also called to the importance of considering, in this connection, the vitally important influence of the great warm ocean-current, the Gulf Stream, in increasing the energy of storms when they reach the coast. By way of more vividly illustrating the energy of action developed when cold winds blow over it, mention was made of the many water-spouts reported off the coast the last few months, and a few of those reports were quoted. It was shown, also, that the surface temperature in the axis of the Gulf Stream off Hatteras was as high as 76°, while that of the cold inshore current was fully 30° lower.

The storm was then followed as it approached the coast, its energy increasing every hour, and the barometric depression deepening. At 3 P.M., one centre, with pressure as low as 29.7, had just passed the coast south of Hatteras; while another, with pressure quite as low, or lower, was central over the Province of Ontario. Although the general trough-like form of the storm remained, as clearly indicated by reports from vessels all along the coast, yet another secondary storm-centre, and one of very great energy, formed offshore, north of Hatteras, as soon as the line had passed the coast. It was this centre, in violence fully equal to a tropical hurricane, and rendered still more dangerous by the freezing weather and blinding snow, which raged with such fury off Sandy Hook and Block Island for two days, — days likely to be long memorable along the coast. Its long continuance was probably due to the retardation of the centre of the line in its eastward motion, by the areas of high barometer about Newfoundland; so that this storm-centre delayed between Block Island and Nantucket, while the northern and southern flanks of the line swung around to the eastward, the advance of the lower one gradually cutting off the supply of warm, moist air rushing up from lower latitudes into contact with the cold north-westerly gale sweeping down from off the coast between Hatteras and Nantucket.

So far as the ocean is concerned, the night of the 11th–12th saw the great storm at its maximum, and its great extent and terrific violence make it to be one of the most severe ever experienced off our coast. Only a few corrected barometric readings were lower than 29, and the lowest pressure was probably not lower than 28.9, although lower readings were observed a few days later off the Grand Banks.

The chart for 7 A.M., March 12, showed the line or trough with isobars closely crowded together southward of Block Island, but still of a general elliptical shape, the lower portion of the line swinging eastward toward Bermuda, and carrying with it violent squalls of snow and hail far below the 35th parallel. The high land of Cuba and Santo Domingo prevented its effects from reaching the Caribbean Sea, although it was distinctly noticed by a vessel south of Cape Maysi, in the Windward Channel. The isotherm of 33° reached from central Georgia to the coast below Norfolk, and thence out into the Atlantic to a point about one hundred miles south of Block Island. Farther north, it ran inshore of Cape Cod, explaining the fact that so little snow, comparatively, fell in Rhode Island and south-eastern Massachusetts.

By next morning the storm was beginning to decrease in severity; and the chart shows that westerly winds and low temperatures had spread over a wide tract of ocean below the 40th parallel, while over the ocean north of that parallel the prevailing winds were easterly. The lower storm-centre was now in about latitude 40° north, longitude 39° west, with a pressure of 29.30; and the other a little distance south of a line from Nantucket to Block Island, barometer 29, the isobars extending in a general easterly and westerly direction. The delay of the storm off the coast, and its rapid increase of energy, had been shown in the most marked manner by the fluctuations of the barometer at land-stations and aboard vessels, and the barometer diagram was referred to by way of illustration.

March 14 the storm off Block Island had almost died away, with light variable winds and occasional snow-squalls; the other centre was about two hundred miles south-east from Sable Island. The great wave of low barometer had overspread the entire western portion of the North Atlantic, with unsettled, squally weather from Labrador to the Windward Islands. The area of high pressure in advance had moved eastward, to be felt over the British Isles from the 17th to the 21st of the month, and after it a rapid fall of the barometer. The isotherm of 32° reached from the southern coast of North Carolina well offshore, thence northward to the coast of Maine, and from central Maine eastward across Cape Breton Island and southern Newfoundland. From the south-eastern to the north-western portion of the chart, the shades of color showed a difference of temperature of more than 80° (from above 70° to below—10°); but such great differences of temperature and pressure could not last long, and the normal conditions were gradually restored.

ELECTRICAL SCIENCE.

Atmospheric Electricity.

The *London Electrician* contains an abstract of a paper by Prof. L. Weber which is of interest. He erected two insulated conductors on the top of the Riesengebirge; but he says, that, curiously enough, since they have been put up, they have never been struck by lightning, although before their erection lightning-flashes were continually occurring. He also made some kite and balloon experiments, in connection with which he goes at considerable length into the question of the effect of the conducting-string in altering the electrical condition of the circumjacent air layers, and also considers the effects due to a long conductor completely insulated from the earth, and without discharging-points; a similar conductor, with slight power of discharge along its whole length; an insulated conductor, with strong discharge-power (e.g., a flame) at the upper end; and other similar and more complicated cases. His kite-string was really a steel wire. The discharge-points of the kite consisted of 400 needle-points. In other cases he had the tails of the kite made of silver paper for the same purpose. The potential was measured by the length of sparks; the current, with a galvanometer. The latter varied in general from .07 to 2.5 micro-ampères. The potential varied generally from 3,000 to 10,000 volts. When thick clouds were overhead, there were no appreciable sparks, the strongest sparks being obtained when the zenith was either quite clear, or when cumulo-stratus clouds appeared. With potentials of 11,000 and 20,000 volts, currents of 4 and 8 micro-ampères were obtained.

Incandescent Lamps with Alternating and Direct Currents. — Professors Ayrton and Perry have carried on a series of experiments to determine whether the efficiency of incandescent electric lamps is the same when supplied with alternating currents and with direct currents. The following table gives the results of measurements on four different lamps: —

Lamp.	No. of Experiments made.	Watts per Candle. *White Light.*			
		Continuous.		Alternating.	
1	20	3.053		3.033	
		Green Light.		*Red Light.*	
		Continuous.	Alt.	Continuous.	Alt.
2	19	2.597	2.534	3.100	3.100
3	20	2.935	2.966	3.254	3.164
4	16	2.900	3.073	3.504	3.477
Mean of last three experiments ..		2.811	2.857	3.286	3.247
		Continuous.		Alternating.	
Mean of all results............		3.049		3.0497	

These results show, that, as far as the economy of the lamp is concerned, the efficiency of the two systems is about the same. What the life of the lamp would be with alternating currents is a matter which has yet to be decided. Considering the rapidity with which small wires respond in temperature to changes in current, it might be, when the period of the alternating current is not extremely rapid, that the filament of a lamp supplied by such a current would be at times at a much higher temperature than the average, at other times at a lower temperature. If this were the case, we would expect that the life of a lamp supplied in this way would be less than that of the same lamp fed by a continuous current. With 300 reversals a second, however, the temperature would vary but little, and there is no reason that the life of the lamp should not be the same with continuous and alternating currents.

Polarization of Platinum Plates. — Mr. C. H. Draper has experimented on the electro-motive force of polarization between platinum plates immersed in dilute sulphuric acid, for different strengths of current passing between the plates, and with different temperatures. It is well known, that, if an electric current be sent between such plates, an electro-motive force of polarization is produced, in a direction opposite to that of the impressed electro-motive force, and of a value something in the neighborhood of one and a half volts. Mr. Draper tried to find if this opposing electro-motive force was independent of the current and temperature, and, if not, in what way it varies with them. The conclusions at which he arrives are as follows: 1. The opposing electro-motive force of polarization which arises in cells when at work depends on the value of the current passing through them when that current is below a certain value, increasing, but more and more slowly, with the current; 2. There is a maximum value of the polarization regarded only as a function of the current strength, beyond which any increase in the strength of the current has no effect upon it; 3. The electro-motive force of polarization varies with temperature, its value decreasing about one per cent for a rise of temperature of 406.

Electric Mining Road at Lykens. — Among the interesting applications of electricity to mining-work, the electric road in the coal-mines at Lykens, Penn., is one of the most successful. It has been pointed out in this journal that electricity offers especial advantages for use at mines where fuel is scarce and water-power of easy access, as in the silver and other mines in our Western territory; but, besides the decreased cost of fuel, the ease with which electric motors can be used in almost any position, under conditions that steam-engines could not meet, makes electric transmission still more valuable. In coal-mines the cost of fuel is, of course, a small item; but the greater safety, efficiency, and flexibility of a system of electrical distribution, as compared with a number of steam-engines, give it an advantage which must soon be recognized. In the Lykens Valley Mines there has been used for some time an electric-motor car to take the place of mules for hauling cars from the mine. The length of the road is 6,300 feet; the weight of the locomotive, 15,000 pounds; the largest load it is capable of handling, 150 tons; the speed, 6 to 8 miles per hour. A second road on the same general plan is being equipped for the same company. The system employed is the Schlesinger.

Designing Dynamo-Electric Machines. — Until very recently the designing of dynamo-electric machinery was an empirical matter. The practice was to roughly guess, from the dimensions of some similar machine, about what the dimensions should be to give the required output, and, after the dynamo was built, to change the number of revolutions or the winding of the field-magnets until the required conditions were fulfilled. Sometimes even this would not suffice to bring the machine to its output, in which case another was built. In the last two years the papers of Mr. Kapp and Dr. Hopkinson, together with the growing habit of treating a magnetic circuit in the same way that ordinary electric circuits are treated, introducing the idea of magnetic resistance, have greatly increased the certainty with which dynamos may be designed. In fact, from experiments on one machine of a type, we can design another of the same type to give any required output, with considerable accuracy. While this is not generally recognized in this country, it soon will be, and a great deal of expense and energy will be saved; besides which, a consideration of the magnetic resistance of various parts of the magnetic circuit of a dynamo should improve the designs of machines now being built. The best dimensions to give the different parts of any dynamo is a perfectly definite problem, involving, besides questions of electrical efficiency, questions of the cost of the iron and wire and labor. However, the problem can be solved, and each maker of dynamos should have it solved. In a recent paper, Professors Ayrton and Perry have considered the magnetic circuit of dynamo machines, and have arrived at some important conclusions. Considering the resistance of the magnetic circuit, they find, that, when a machine is working at its best permanent output, its iron magnetic resistance plus the air magnetic resistance of the clearance is equal to the air magnetic resistance of the space on the outside of the armature occupied by the winding. The paper of Professors Ayrton and Perry, with those above mentioned, will greatly aid in the improvement of dynamo-electric machinery.

MENTAL SCIENCE.

The Relative Legibility of the Small Letters.

READING is one of the most widespread of modern activities, and the endless multiplication of books and cheap editions makes a study of the factors of this process of great importance. In the end the process reduces to the differentiation of black or colored marks on a white or colored surface. 'Black on white' is current as an expression for clearness, leaving the question of the shapes of the letters as the important one. Inasmuch as the Roman alphabet is in use for the chief languages of civilization, and a large majority of the characters are formed by the small letters, the investigation of the forms of these letters is naturally the point of prime value. If by any means we can make the reading of these letters an easier task, the improvement, however minute, when multiplied by the number of times the letter is read, will be very great. This is, however, not the only consideration. Tint and quality of paper, length of lines and spaces between them, the size of the letters and their distances from one another, — all affect the legibility. The end to be aimed at is to attain "the greatest legibility to the square inch," with due regard to taste and economy. The solution of this problem has been experimentally attempted by Dr. Javal and by Dr. Cattell, and has recently been again studied with improved apparatus by Mr. E. C. Sanford (*American Journal of Psychology*, May, 1888).

The first method of obtaining an order of legibility of the letters consisted in measuring the distances at which they could just be read. The letters were fastened to the edge of a rotating disk, and were viewed through a square hole of 2 centimetres, in a black screen placed in front of the disk. Test-type letters of a clear bold pattern were used, the short letters being about 1.8 and the long letters about 2.2 millimetres high. The whole apparatus was mounted on runners sloping upwards from the floor at an angle of about fourteen degrees, and could be moved to any distance from the eye by pulling an endless cord.

The first method of these distance-tests consisted in showing the letters at a fixed distance for the whole alphabet, and noting the number of times each letter was rightly and wrongly named, as well as the letters with which it was liable to be confused. Another fixed distance is then chosen, and the test repeated. The result, with five subjects and the letters at distances varying by 10 centimetres from about 1.5 to 3.2 metres, was as follows, the numbers expressing the percentage of cases in which the letters were correctly read: —

m, 90.9	*v*, 71.0	*x*, 63.0	*n*, 46.2
w, 88.1	*k*, 70.9	*a*, 60.8	*e*, 46.2
f, 84.4	*b*, 70.4	*i*, 60.6	*c*, 45.1
p, 84.3	*y*, 70.4	*l*, 58.6	*o*, 44.9
q, 80.9	*h*, 69.9	*u*, 55.2	*z*, 34.1
r, 78.7	*d*, 68.3	*s*, 53.0	
j, 77.6	*g*, 68.2	*t*, 46.5	

These percentages are based on about three hundred answers for each letter, the preferred letter being counted as the only answer in cases of doubt between two or more letters.

From the same record we can obtain an order of the liability of the letters to confusion and the chief causes of confusion. This order is substantially the same as the former, and would be still more closely like it were it founded on precisely the same data. The order, with the letters most likely to be confused with them, as well as the percentages of cases in which the confusion occurred, are given below: —

m with *w*, 52.	*h* with *b*, 51.
w " *v*, 53.	*x* " *n*, 19; *z*, 15.
p " *r*, 44.	*a* " *u*, 16; *n*, 14; *s*, 13.
f " *r*, 37.	*s* " *n*, 14; *cr*, 12.
r " *v*, 22.	*l* " *i*, 39; *j*, 36.
q " *g*, 30.	*u* " *a*, 18; *z*, 12.
j " *l*, 25; *f*, 21.	*i* " *l*, 58.
v " *r*, 33.	*t* " *i*, 40.
y " *p*, 61.	*n* " *a*, 41.
d " *ag*, 22.	*e* " *c*, 40.
g " *r*, 12; *t*, 10.	*z* " *e*, 19; *s*, 17; *a*, 16.
b " *h*, 45.	*c* " *e*, 34; *o*, 23.
k " *x*, 34.	*o* " *c*, 34; *e*, 23.

Mr. Sanford also tested the letters by setting them so far away that they could not be read, and then having the subject slowly draw them near until he could read them; in general, recording both the distance at which the subject would first hazard a guess, and the distance at which he felt confident that he had correctly read the letter. Here differences in eyesight of the subjects tested make average results meaningless, but the order for any one subject agrees fairly well with that obtained by the other test. If the letters be divided into three groups of eight, ten, and eight,— calling those in the first group good, those in the second fair, and in the third poor, — all the orders agree in making *w*, *m*, *q*, good; *b* and *x*, fair; and *z*, *o*, *c*, *s*, *e*, poor: and the balance of the evidence goes to make the good letters, *w*, *m*, *q*, *p*, *v*, *y*, *j*; the ten fair ones, *h*, *r*, *d*, *g*, *k*, *b*, *x*, *l*, *n*, *u*; and the eight poor ones, *a*, *t*, *i*, *z*, *o*, *c*, *s*, and *e*.

By an ingenious apparatus a dark box in which one of the letters was set could be illuminated for a very minute yet accurately measurable time, and the proportion of cases in which each letter could be correctly named when seen for a definite fraction of a second would again measure its relative legibility. The letters were exposed for times varying from .0013 to .004 of a second, and each letter was shown about two hundred times. A table comparable with that for distance is given below: —

m, 82.	*p*, 61.	*h*, 47.	*n*, 34.
w, 73.	*k*, 61.	*r*, 43.	*e*, 33.
d, 67.	*f*, 58.	*x*, 42.	*s*, 27.
q, 66.	*b*, 52.	*t*, 39.	*c*, 26.
v, 63.	*l*, 49.	*o*, 39.	*z*, 23.
y, 62.	*i*, 48.	*u*, 38.	
j, 61.	*g*, 47.	*a*, 35.	

The order of legibility by the two methods agrees very well, and yields the important conclusion that the letters read at the greatest distance are also the letters most rapidly recognized at an ordinary distance. The order for the two methods, as well as that found by Dr. Cattell by a different mode of time-measurements, are: —

Order for time,	*mwdqvyjp*	*kfblighrxt*	*ouanescz*
Order for distance,	*wmqpvyjf*	*hrdgkbxlnu*	*atizocse*
Order for time (Cattell),	*dkmqhbpw*	*uljtvzrofn*	*axyeigcs*

It so happens, that, of the eight letters most fully represented in a full font of type, three (*e*, *a*, *s*) are the very letters that all the tests agree in regarding as the worst, and six (*e*, *a*, *s*, *o*, *i*, *t*) are among those regarded as poor by two of the results.

Among the deductions formed from this study are, that the concentration of differentia is an important aid to clearness, while the lack of it leads to confusion. Thus, *b*, *d*, *p*, *q*, are all made of a straight stem and a loop, and yet are easily distinguished (except that *b* is confused with *h*); while *g* and *a*, though having few points in common with other letters, are confused with several. The group of confusables (*e*, *o*, *c*) should be differentiated, the *c* being left wide open, and some other form, such as the Greek ε, or an E with square corners, substituted for *e*: *u*, *n*, *a*, should be similarly treated; *u*, *a*, *n*, having their openings kept well open, and *a* changed perhaps to an inverted *v*; *s*, too, needs reform, and a shape like *ʃ* was found to have several advantages. Though not final, these observations show what letters are good, and to a certain extent why they are so; they similarly point out those that need reform, and suggest the direction in which reform should take place, and, quite as important, furnish us with a method of accurately testing the advantages of any system of letters that may be proposed.

One remark should be added. It is, that the legibility of the letter is not altogether an objective factor, but depends on the familiarity of the letters to the person reading them. Just as it has been shown that we are not as likely to name or write one number as another when told to name a number, so the letters are not equally present to our minds; and certain letters will be more often recognized or confused because we more constantly have them in mind. The same process operates against the comparison of a new form of letter with a conventional form; for the new one, not being familiar, is less likely to be recognized because more rarely present to the consciousness of the subject. Similarly, if the subject is informed that a certain letter is no longer to be shown, the very same impression that would have led him to pronounce in favor of the omitted letter will now have a different effect. In the experiments a similar result, due to the omission of a certain letter without the knowledge of the subject, was observed.

NOTES ON HYPNOTISM.[1] — Dr. A. Dichas has made a detailed study of the memory in the hypnotic state, and summarizes his main conclusions somewhat as follows: (1) during the hypnotic sleep the subject remembers the experiences of his waking life as well as of previous hypnoses; (2) in hypnotism there is often an exaltation of the memory, and at times a change in its content, leading to the assumption of a foreign personality; (3) the memory of what has been going on during hypnosis is usually lost, it can often be revived by a simple suggestion, and at times the memory of a suggested hallucination may linger on, and influence the waking condition; (4) the operator can at his will have any of the acts of the hypnotic state remembered or forgotten by making this a part of a suggestion; (5) suggestion seems to be largely explicable as unconscious memory. —— Dr. Cybulski has studied the power of hypnotic subjects to hypnotize themselves. He finds that such subjects strongly imagine for a minute or less that the operator commands them to go to sleep, and the desired result ensues. Furthermore, if the subject, on going to sleep, imagines himself controlled by a certain person, then, even though another sent him to sleep, he will be subject to the former, and not to the operator. These observations show the importance of the subjective element in the process of hypnotism, and indicate the method by which the subject unconsciously takes suggestions and acts upon them. —— Dr. Berkhan has applied hypnotism to the amelioration of the hearing of the deaf. He tested the hearing of nine deaf boys, and, after hypnotizing them, spoke to them and had various noises made before them. The hearing of four of them was found to be improved, and the improvement is reported as still persisting after eighteen months.

[1] The reader is referred to an exhaustive review of works on hypnotism in the May number of the *American Journal of Psychology*.

HEALTH MATTERS.

Alcoholic Trance.

DR. T. D. CROTHERS of Hartford, Conn., at the recent meeting of the American Medical Association at Cincinnati, read an interesting paper entitled 'Alcoholic Trance: its Medico-Legal Relations.' In discussing this subject he said that the statements of prisoners that they had no memory or recollection of the crime, or the circumstances associated with it, are not often doubtful excuses to avoid punishment. Certain physiological conditions, supported by clinical facts, indicate beyond all question that such statements are often psychological truths.

In somnambulism the person may go about, and do many intricate acts, without consciousness or recollection of them afterwards. In epilepsy distinct periods of unconsciousness occur. Acts unusual and often violent follow, which are never remembered. In mania these memory-blanks are common, and the person is an automaton, acting without any conscious influence of the present. These are familiar illustrations of some unknown pathological and psychological states of the brain, in which memory is suspended or cut off, and the operations of the mind go on without realization of the surroundings or the influence of experience. This is some obscure form of psychological palsy, in which the person has no recollection of his acts during this time.

From the many clinical studies of cases which have been made, the following general conclusions seem to be sustained: —

1. Alcoholic trance is not an unusual condition in inebriety. The victim is literally an automaton, and acts without memory or consciousness of passing events, — a state which may last from a few minutes to several days.

2. It is distinct from epilepsy, hysteria, or any known forms of mania, and is found associated with some unknown condition following alcoholic poisoning, continuously or at intervals.

3. This condition is probably one of brain-exhaustion, followed by a lowering of consciousness till events are no longer clearly remembered; or a suspension of nerve-force in certain directions, closely allied to paralysis of certain brain-functions: hence there are profound disturbances of brain-centres, and impaired and lessened responsibility.

Dr. Crothers has obtained the records of a large number of trance cases, and his paper gives many of these in detail.

One group of trance cases seems never to do any thing outside a natural, accustomed order of every-day life. Thus, a farmer in this state goes on with his regular work. A physician continues to visit patients, and a railroad-conductor attends to all his usual duties, without any memory of these states. A second group of trance cases seems prominent by unusual acts and thoughts. Thus, a banker in this state left his regular work, and went round delivering tracts in the lower parts of the city. A quiet, retiring man became vociferous, bold, and aggressive. A peaceful man was combative, a truthful man untruthful, and a conscientious, religious man was treacherous and sceptical. Later, these events were perfect blanks in their memory. In a third group of trance cases, some unusual line of conduct seems to grow out of the surroundings unexpectedly, or some old buried thought or conception comes to the surface. Thus, a clergyman insists on riding with the engineer on the engine. A sceptical physician takes part in a prayer-meeting. A merchant goes round threatening to kill an old schoolmaster who punished him in boyhood. A wealthy man has a new will written, disposing of his property differently every time.

In the two last groups criminal cases occur most frequently, although some very remarkable instances have been reported under the first group. In a little work entitled 'Alcoholic Somnambulism,' Professor Jerusky of St. Petersburg mentions the case of a chief of police, who was an inebriate, ordering the arrest and execution of two suspected Jews. His orders were carried out in form, but not in reality. A day later he recovered from his trance state, and had no recollection of the past: he had total amnesia of this act. Another case is cited of an officer who ordered a house burned down, on the supposition that its inmates were preparing to destroy his command. Two days later he awoke with no memory of this event, and could give no reason for the act.

In these cases the somnambulistic act was along the line of his usual work, and performed without the slightest consciousness of its nature or consequences.

The criminal trance cases may be divided into two classes, one of which seems to have no history of criminality previous to the commission of the crime. They are inebriates of active neurotic temperament, who have occupied reputable stations in life, and belong to the better classes. All crime is unusual with them, and apparently grows out of the alcoholic poisoning. The second class are the low neurotics and defectives by birth and education. They have a history of irregularities of life and conduct that seems to prepare the way for criminal acts, and probably are more subject to the trance state because of defective heredity.

All these cases in court are unrecognized. A degree of reasonable conduct up to the time of the crime, and after it, is assumed to be evidence of knowledge of the surroundings and consequences of the act. No fact of inebriety, or statement of no recollection, is thought to lessen in any way the responsibility of the act.

Clinical facts indicate that in all cases of inebriety there is a defective brain-power and general perversion of healthy activity; also the door is open for many varied nerve-changes and degrees of brain instability, which always give a doubt to the sanity of the victim. The fact of being an inebriate points to an unsound mind, and more or less incapacity to act or think normally.

When the trance state is determined, the actual responsibility, or cognizance of right or wrong, is suspended: the person is a mental waif, without compass or chart. No evidence of premeditation or apparent judgment in his actions can change this fact. Any special act may spring from some impression laid up in the past, which, when conscious reason is withdrawn, takes on form and semblance. The real condition of the mind is always more or less concealed. Where the case is a periodical inebriate, with distinct free intervals of sanity, a possibility of concealed or masked epilepsy should always be considered. Epilepsy is likely to be present, or to follow from some organic tendency or favoring conditions. When this defence of no memory of the act is made, the case should receive a thorough medical study before any conclusion of responsibility can be reached.

The present treatment of inebriates in courts is nothing less than legal barbarism, founded on error and superstition. The oft-repeated statement that "drunkenness is no excuse for crime," assumes a definition of inebriety that has no support from scientific study and the teaching of facts.

Inebriety in all cases must be regarded as a disease, and the patient forced to use the means of recovery. Like the victim of an infectious disease, his personal responsibility is increased, and the community with him are bound to make the treatment a necessity.

The following propositions sum up many of the facts mentioned: —

1. Inebriety must be recognized as a condition of legal irresponsibility to a certain extent, depending on the character and circumstances of the case, and the general mental integrity displayed.

2. All unusual acts or crime committed by inebriates, either in a state of partial coma or alleged amnesia, which come under legal recognition, should receive thorough study by competent physicians before the legal responsibility can be determined.

3. When the trance state is established beyond doubt, he is both legally and practically irresponsible for his acts during this period, and each should be measured by the facts of its individual history.

4. Inebriety is a disease requiring physical means in the treatment. Society demands of the patient that he use diligence to recover; and, so far as he may neglect this, both himself and community are responsible.

5. It is the duty of the State to provide asylums, and encourage private enterprise to furnish the means and appliances for restoration.

6. Lastly, standing on this borderland, and looking back at the monstrous injustice and legal crime that is daily committed in the punishment of inebriates, who are practically insane, I am convinced that the time has come for a revolution of sentiment and practice, in which both the inebriate and the community must be held responsible, not alone for his acts or the consequences of them, but the causes and conditions which have developed in this way; then the victim will be forced to avail himself of every means for prevention, restoration, and recovery.

A NEW MILITARY RATION. — All the garrisons within the limit of the Seventh German Army Corps, we learn from the *Medical Herald*, have now been provided with larger samples of the new article of food which is in future to form the so-called 'iron ration' of the men in the field. It is a peculiar kind of bread, in the shape of small cubes the size of a chocolate-drop, made of fine wheat-bread, strongly spiced, and calculated to keep for a long time. When taken into the mouth, it quickly softens, and is both palatable and nutritious. It is chiefly intended for forced marches, when there is no time for camping and cooking.

WOUNDS OF THE ABDOMEN. — Modern surgery, aided by antisepsis, has enabled surgeons to accomplish results which, twenty-five years ago, would have been deemed impossible. This is in no department more marked than in abdominal surgery. While formerly a wound of the abdomen, either from a gunshot or a stab, was considered almost necessarily fatal, at the present day many lives are saved by an operation, which consists in opening the abdomen, tying every blood-vessel that may have been lacerated, and sewing up any wound which may have been made in the intestines. One of the most difficult parts of the operation consists in finding the intestinal wound. Dr. Senn of Milwaukee proposes to inject per rectum hydrogen-gas, which, he has demonstrated in dogs, finds its way through the entire length of the intestine; and, if an opening exist, the gas will escape, and can be detected.

BOOK-REVIEWS.

Three Introductory Lectures on the Science of Thought. By F. MAX MULLER. Chicago, The Open Court Publ. Co. 12°.

THESE lectures were delivered last year at the Royal Institution in London, and are intended as an introduction to the subject of which they treat, and which the author has dealt with more largely in his work on 'The Science of Thought.' Many writers before Professor Müller had maintained that language is necessary as an instrument of thought, so that we could not think without it; but he goes much further than this, and maintains that language and thought are identical. This means, if taken literally, that the word 'orange,' when I pronounce it, is identical with the idea of an orange which I have in my mind. When stated in this concrete form, the absurdity of the theory is manifest, but Professor Müller endeavors to escape the absurdity by explaining that the word he identifies with the idea is not the word as actually uttered by the voice and heard with the bodily ear, but the word as heard mentally, or in imagination. This, however, does not remove the difficulty; for the word as heard mentally is not a word at all, but only the idea of a word; so that, when stated in this way, the theory means that the idea of a word is identical with the idea of the thing that it stands for.

Such, then, is the absurdity inherent in Professor Müller's theory; nor does he succeed in removing it in any way: on the contrary, he aggravates it by the addition of others. For instance: in his preface he undertakes to tell us how language first arose; and in so doing he gives himself away to start with. According to his theory of thought, we cannot have a concept, or general idea, until we have a word to symbolize it; and he ought, therefore, to account for the origin of language without assuming any concepts whatever. We need not here repeat his whole account of the matter; but he maintains, that, "before we can get a single conceptual word, we have to pass through at least five stages," and the first of these stages is "consciousness of our own repeated acts." Now, this consciousness involves at least four concepts: (1) the concept of an act, since it is not a single act that we are conscious of, but a series of acts; (2) the concept of number, or of many as distinguished from one; (3) the concept of repetition; (4) the concept of causation, since the acts are regarded as our acts, that is, as caused by us. Thus, according to Professor Müller's view of the origin of language, we must have had at least four concepts before we had a single word; and, if this is so, what becomes of the theory that we cannot have concepts without words? As another example of Professor Müller's reasoning, take his remarks about the thinking of animals. Some one had remarked that animals think, to a certain extent at least, and that this proves that thought is not identical with language, to which Professor Müller replies in this curious way: "If we mean by thought that mental function which has its outward sign and embodiment in language, we must say that animals do not think as we think, namely, *in words*. They may think in their own way. . . . But I cannot allow that they think, *if we define thinking by speaking*." A more ludicrous example of reasoning in a circle it would be impossible to find.

Professor Müller's theory is such a one as we often get when a scientific specialist undertakes to deal with the problems of philosophy. Such a man is apt to think that all philosophical problems can be solved by the methods and principles of his science; and the consequence is a great deal of unphilosophical reasoning. Thus, we have had mathematicians who thought that mathematics was the key to philosophy; and in our own time the biologists have put forth similar claims; and now comes Professor Max Müller, maintaining that philosophy is only a problem of language. But philosophy is broader than any science, broader than all sciences together, and cannot be comprehended under the formulas of any of them.

Bibliographie des Modernen Hypnotismus. Von MAX DESSOIR. Berlin. 8°.

TO realize the great activity in the study of hypnotism now present in all parts of the civilized world, nothing could be more serviceable than this bibliography. There are included no less than eight hundred titles; and these are devoted to the modern, scientific phases of the study alone, excluding references to the history of the topic, as well as the works of those who wrote when the topic was in a pseudo-scientific stage. By this plan seven-eighths of all the writings catalogued fall in the period since 1880. The increase of interest in the topic since 1880 can be read off from the increase of publications year by year. In 1880 there were published 14 works pertinent to this bibliography; in 1881, 9; in 1882, 39; in 1883, 40; in 1884, 78; in 1885, 71; in 1886, 131; in 1887, 205; in 1888 (January to April), 71. The countries in which the activity in hypnotic studies is greatest are likewise indicated by the languages in which the publications are issued: 473 are in French; 102 are in English, of which 40 come from America; 88 in Italian; 69 in German; 22 in Danish; 16 in Spanish: 12 in Russian; 6 in Dutch; 4 in Swedish; 3 in Norwegian; 2 each in Polish and Hungarian; 1 each in Portuguese and Roumanian. The classification of the topics is a very convenient one. We have first the general works (191 in number); then those with a more special medical interest (of which there are 199); next those on magnetism (36), on the physiology of hypnotism (62), on its psychological and pedagogical aspects (85), on its forensic aspects (43); and, finally, sections on telepathy (81), mesmerism (58), and miscellaneous (46). Under each section the titles are arranged by date of issue, and cross-references to other sections are given. There are also references to the numbers treating of the works of the Nancy school, of the Paris school, the question of simulation, of suggestion, of the practice of hypnotism and its theory. No trouble has been spared to make the bibliography convenient; and, to enable the author to maintain its completeness, he requests that books and articles on the topic be sent to him at W. Köthenerstr. 27, Berlin, Germany.

Die Ekstasen des Menschen. Von PAUL MANTEGAZZA. Tr. by Dr. R. Teuscher. Jena. 8°.

LIKE many of his eminent countrymen, such as Lombroso, Morselli Sergi, Buccola, Vignoli, Mantegazza belongs to the psychological school of naturalists, and devotes his main efforts to bringing into the domain of science groups of facts that have hitherto been left to grow wild in the open road of speculation, or have been perversely cultivated at the hands of mercenary pseudo-scientists. His three works treating from various points of view, but with the anthropological, pedagogical, and psychological interests ever uppermost, of the sexual relations of mankind, indicate one phase of his labors, while another is suggested by his work on facial expression. He combines with his scientific interests a deep feeling for nature, both in the phenomena of land and sea and in that more specially inviting subject conveniently termed 'human nature;' and this is brought to the front in his essay on the art of being happy (*Science*, Dec. 9, 1887). Add to this that the author is a wide traveller, a careful reader, and an excellent stylist, and it is not difficult to understand that whatever he writes is likely to be interesting reading. In the present volume this expectation would not be disappointed. Under the head of human ecstasies are here included all those many extremes of emotion that lead to the forgetting of self, and in their extreme forms to a condition closely allied with the phenomena of hypnotism. It is this connection that lends an especial interest to the study of these phenomena, and rescues many apparently incredible and inexplicable narratives, especially in the history of religious devotion, from the scepticism with which they have been regarded. Moreover, as scientific psychology widens its domains more and more, it finds a large class of phenomena capable of only such a lenient and elastic treatment as are the classification and description of diseases. At best one can empirically describe and diagnose, leaving it to the future to gain a clearer insight and to deduce important generalizations. By singling out the ecstasies of mankind as the heading of a chapter in descriptive psychology, Mantegazza has done a real service to that science, which he himself acknowledges is still in its 'prattling' stages.

Rudimentary forms of minor ecstasies are to be found in animals. There are not only love ecstasies, but, as those passionate delights in activity visible in an unchained dog indicate, a motor type of ecstasy; while the admiration of the bower-bird for its work of art, or the self-admiration of the strutting peacock, shows the beginnings of an æsthetic absorption. In man, and more especially in the man of civilization, the forms of ecstasy are many. We see not only ecstatic states brought about by the exercise of normal physiological functions, but even more by extreme devotion to artificially acquired possessions. Under the first head we contemplate the all-absorbing love of a mother for her child leading to deeds of astounding self-sacrifice, and to moments of rapturous adoration; we witness, though more rarely, the devotion of child to parent, remaining as a rule on a more respectful, contemplative stage; we read of the mutual love and devotion of brothers and sisters, of the soul-stirring compact of friend with friend that played so large a *rôle* in the friendship of classic times; we must even add the instances of Platonic love so often decried as impossible, but warmly defended by Mantegazza, to the crowning passion of romantic love, if we are to grasp the broad extent of the ecstatic horizon. The most interesting as well as the most completely described ecstasies are those connected with religion. These are most closely akin to the exaltations of love, and the devotee often calls herself (for women are more prone to this than men) the bride of her Saviour. Mantegazza confines his descriptions to the ecstasies of Christian religionists, though he could have found material in the history of all Oriental religions. St. Theresa is the type of religious ecstatics, and the minute description of her own feelings and passions that she has left form a very interesting psychological document. With her the deepest passion was for a more intimate communion with the divine essence, — a religious contemplation freed from the trammels of a sensuous life. Of such a nature, too, were the ecstasies of Plotinus, by which his philosophic insight was gained. This is the condition that leads to mysticism, and it has been claimed that a similar state of supersensuous, dreamy abstraction follows the taking of certain drugs. In another kind of religious ecstasy the passion for self-denial and self-torture is uppermost. The feeling that every transgression, however slight, must be absolved by inflicting pain, the feeling of unworthiness, of being a sinful being, seizes the soul, and drives the devotee onward to more and more intense tortures, until pain is no longer felt and the body subjugated. Here occur such marvels as the stigmata, or flowing of blood from definite regions of the skin, in the shape of a cross, or from the hands and feet. The same thing has within recent years been witnessed in very sensitive hysterical hypnotic subjects as the result of a suggestion, and thus indicating what an extreme influence nervous states have over normally automatic, involuntary processes. The conditions of cataleptic rigidity, of trance that we now artificially induce, were seen in religious ecstasy, and, according to the beliefs of the time, were converted into cases of possession by evil spirits. Asceticism, with hallucinations caused by fasting and fatigue, is another fertile cause of religious ecstasy. All these instances deserve careful study from all who would grasp the various forms in which mental phenomena present themselves in nature.

Patriotism may be so supreme a motive in a man's life that it acquires an ecstatic intensity, and in Mazzini our author finds such an ecstatic. We must also condescend to enumerate under the same head all the devotions of men to favorite pets. There are real cases of ecstatic love of a master to his dog, his horse. Here, too, belong all those hobbies and mania (crazes) that, according to their nature, save the mind from *ennui* and inactivity, or blunt the susceptibilities. The miser gloating over his gold, and the book-collector over a musty treasure, are both in a minor form of ecstasy. There remain a large class of high emotional and intellectual ecstasies in which genius finds its sphere. The æsthetic raptures, whether addressed to the beauties of nature or of art, are among the most real and ennobling, because they touch one of the deepest chords of the human soul, and one that has ever responded to the advance of human culture. The ear, as well as, and even more readily than, the eye, becomes the avenue by which ecstasy is approached; and the wonderful effects of martial strains, or the deeply touching notes of the human voice, have always been among the poet's favorite themes. Ecstasies of thought, of contemplation, are vouchsafed to the few. Kant declared that nothing so filled him with awe as the starry heavens above and the moral law within, thus indicating two approaches to ecstasy. The flights of poetic imagination, creating worlds harmonious and beautiful, are of a kindred nature. The swaying of the masses by the eloquence of a born orator, who forgets himself and his hearers and feels himself inspired for the occasion, is another phase of this same ecstasy. The intoxication of power that so often leads to its abuse, and has given rise to the phrase 'insanity of power,' is again a type of ecstasy. Finally, all those moments of fruitful discovery when the mysteries of nature are glimpsed, a new contribution to human knowledge made, a novel train of thought begun, are moments of creative ecstasy. In every field of human activity there are possibilities of greatness; and all these have a common element, just as the views from all high mountain-peaks present a close similarity. From the study of these ecstasies, we return with a fuller appreciation of their grandeur and their value, with a realization of their dangers when diverted into morbid channels; we realize, too, what a great *rôle* they have played in human history; and they suggest that man cannot be more aptly described than by defining him as an inspirable animal.

NOTES AND NEWS.

D. C. HEATH & CO. will publish shortly a translation of Paolo Mantegazza's 'Testa, a Book for Boys.' It is a companion book to De Amicis' 'Cuore.' The translation will be made under the supervision of Prof. L. D. Ventura of Boston, and of the Sauveur Summer School of Languages. —— Cassell & Co. have nearly ready a second edition of 'Yachts and Yachting.' The original work consisted of four papers, — 'A History of American Yachting,' by Capt. R. F. Coffin; 'The Mayflower and Galatea Races of 1886,' by C. E. Clay; 'American Steam-Yachting,' by E. S. Jaffray; and 'British Yachting,' by C. J. C. McAllister. These papers had one hundred and ten illustrations by F. S. Cozzens, comprising pictures of all the famous yachts of recent times. C. E. Clay has now covered the subject from 1886 to date, and Mr. Cozzens has provided sixteen new cuts. —— The J. B. Lippincott Company have in press 'An Elementary Treatise on Human Anatomy,' by Joseph Leidy; 'A Cyclopædia of Diseases of Children,' by Dr. J. M. Keating; 'Animal Life of the Seashore,' by Angelo Heilprin in the International Scientific Series; and 'A Popular History of Music,' by James E. Matthew, with one hundred and fifty illustrations, consisting of portraits, musical instruments, facsimiles of rare and early musical typography, etc. —— Frederick Warne & Co. have in preparation 'A Pictorial Natural History Library,' in three volumes, which will teach with more than a thousand illustrated pictures the facts that children devour so greedily. —— W. B. Clarke & Co. (successors to Clarke & Carruth), 340 Washington Street, Boston, will publish shortly 'Among the Theologies,' by Hiram Orcutt, LL.D. —— Ginn & Co. have just ready Benjamin Franklin's autobiography, with notes and a continuation of his life, by D. H. Montgomery; 'Topics in Ancient History,' by Miss C. W. Wood of Holyoke Seminary; 'Arabian Nights,' in their series of Classics for Children; 'Cæsar's Army,' a study of the military art of the Romans in the last days of the Republic, by Harry Pratt Judson of the University of Minnesota; 'Descriptive Geometry,' by Linus Faunce of the Massachusetts Institute of Technology; 'Entrance Examination Papers,' compiled by Dr. John S. White of the Berkeley (New York) School; and questions prepared to accompany Fiske-Irving's 'Washington and His Country,' as a help to teachers using this as a text-book of United States history. —— Scribner & Welford have just ready a volume entitled 'Princetoniana — Charles and A. A. Hodge, with Class and Table Talk of Hodge the Younger,' by a Scottish Princetonian, the Rev. C. A. Salmond, which contains a full biography of Rev. Dr. Charles Hodge (1797–1878), and of his son, the Rev. Dr. A. A. Hodge. Excellent portraits of the two professors, as well as one of Dr. McCosh, contribute to the attraction of this volume. They have also just ready a volume on 'Tropical Africa,' by Henry Drummond, who gives a remarkably interesting account of his recent travels in Central Africa, with one or two chapters of natural history, and notes regarding the latest phases of the slave-trade and African politics generally. They will shortly issue 'The Letters of Frederica Sophia Wilhelmine, Margravine of Baireuth, and Voltaire.' —— Harper & Brothers published on the 15th inst. 'Stepniak's' last book, 'The Russian Peasantry,' for which it is claimed that it is the most instructive and interesting work that has been produced by this remarkable writer, and is written evidently with self-restraint. They will soon issue in book form the practical house-keeping articles which have been contributed to *Harper's Bazar* by Christine Terhune Herrick, a daughter of Marion Harland. —— *The Chautauquan* for July gives the location of forty-three summer assemblies modelled after the original one at Chautauqua, N.Y., and an outline of the work done in each. Of these assemblies, forty-one are located in twenty-one different States and Territories of the United States, one is in Canada, and one in England. The sessions vary in length from three days to two months. —— In John Bogart's article on 'Railway Engineering Feats,' in the July *Scribner's*, will be a full account of life in a pneumatic caisson, far below the surface of the water, during the construction of bridge foundations.

— *Nature* states that the following were elected foreign members of the Royal Society on Thursday, May 31: Prof. Edmund Becquerel of Paris, distinguished for his researches on the effects of light on bodies, especially with reference to phosphorescence; Prof. Hermann Kopp of Heidelberg, for his researches on atomic volumes and boiling-points; Prof. Eduard F. W. Pflüger of Bonn, for his researches in physiology, especially in relation to irritability of nerves, respiration, and animal heat; and Prof. Julius Sachs of Würzburg, for his researches in botany, especially vegetable physiology.

— A despatch from Brussels dated June 18 states that the Kongo officials here think that the report received from a messenger from the Aruvimi was due to confusion regarding Ward's journey. Still they are anxious as to Stanley's fate, chiefly because Emin Bey had heard nothing of Ward, and had received almost positive confirmation of the hostility of tribes between the Aruvimi and Wadelai from officers who had journeyed there. Several Belgian explorers offer to go in search of Stanley, but only by the Kongo route and with a caravan of at most twenty men.

— The House Committee on Appropriations proposes to reduce the field force of the Coast and Geodetic Survey from sixty-two to fifty-eight men.

— The commissioner of fish and fisheries has asked for an appropriation of thirteen thousand dollars for the establishment and maintenance of a fish-cultural station, under the United States Fish Commission, in the Ozark region in south-western Missouri. The commissioner says that the neighborhood of Neosho, Newton County, Mo., affords favorable conditions for the establishment of such a station.

— Mr. William Walter Phelps has introduced into Congress a bill to purchase from Stephen Vail of Morristown, N.J., the original telegraphic instrument, or recording receiver, invented by his father, Alfred Vail, and used upon the first telegraphic line ever constructed, — that between Washington and Baltimore, — and to transmit the first message ever sent: "What hath God wrought?" The purchase of this instrument is strongly recommended by the officers of the Smithsonian Institution. The price is ten thousand dollars.

— In *Science* of March 26, 1886, our Vienna correspondent referred to the then newly invented gas-lamp of Dr. Auer of Welsbach, Austria. The principle of Dr. Auer's lamp is no new one. Every one knows the Drummond light, in which a cylinder of lime is brought to incandescence by a burning mixture of hydrogen and oxygen. But all lights of that character have failed to come into commercial use, because the material to be acted on by the heat has always been present in considerable mass, and has required gas under pressure and a very high temperature to bring the mass to incandescence. In the Welsbach light, now on exhibition in New York, the incandescent substance is used in an extremely thin or attenuated form, requiring the minimum heat to produce the maximum of light. The principle of the invention will be understood when it is described as a hood or mantle of finely divided but perfectly coherent refractory oxides of lanthanum, zirconium, and yttrium round the flame of a Bunsen burner. The lamp has given satisfactory results so far.

— We learn from the *Engineering and Mining Journal* that the Alliance Aluminium Company has been formed in London, England, with a capital of £500,000, for the purpose of manufacturing aluminium, sodium, and potassium. The company owns the English, German, French, and Belgian patents of Professor Netto for the reduction of aluminium from its compounds, and for the manufacture of sodium and potassium; the processes of Mr. Cunningham for the reduction of the above metals; a process for the manufacture of artificial cryolite by the regeneration of its slags, provisionally protected by the inventor, Mr. Forster, Lonesome Chemical Works, Streatham; a process invented by Professor Netto and Dr. Saloman, of Essen, Germany, by which this metal can be raised to the highest standards of purity on a commercial scale. Exhaustive experiments have been made at the works of Krupp at Essen to test the practical value of the processes, and it is stated that he has the means of making the metal in tons. Instead of beads or marbles, solid chunks of the purest aluminium known, weighing from five pounds to one hundred pounds (according to the size of the converter), are deposited at every fusion of the ingredients, chief among which are sodium and cryolite. The company has a contract with the owners of the cryolite-mines in Greenland to supply it with practically the entire output. It is stated that the patents of the company enable it to manufacture it at considerably less than one shilling per pound.

— An interesting fact in the history of the movement for industrial training in the public schools of Washington is its connection with Cooper Union, that unique institution of which New York is so justly proud. As already stated in *Science*, industrial drawing, including moulding in clay, and construction in card-board, etc., has long been a feature of the Washington schools. The supervisor of drawing, Mrs. S. E. W. Fuller, who for fifteen years has guided the work, was trained in the Cooper Union in those early days when, with an enthusiasm and thoroughness not excelled by later institutions and a wise prevision of coming demands, it brought art and industry into their proper relation as means and purposes of education.

LETTERS TO THE EDITOR.

**** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

Twenty copies of the number containing his communication will be furnished free to any correspondent on request.

The editor will be glad to publish any queries consonant with the character of the journal.

An Unusual Auroral Bow.

I WAS much interested in Mr. D. S. Kellicott's communication in your issue of June 1, describing a peculiar form of northern lights; particularly so, as it was my fortune to witness a similar phenomenon in 1881. On July 2 of that year, the day on which President Garfield was shot, at about 9.20 in the evening, faint streaks of light were observed on the northern horizon. I then observed a streak of cloud-like light ascending at about the east-south-east horizon. Looking around, I saw a similar streak at an opposite point. In a short time these streaks blended into one in the zenith, forming an arch overhead. There was a bend or crook in this arch; just at what point I do not remember, as I made no note of it, but I think at or near the middle. Presently the streak began to grow narrower; then it changed and broadened again, until it became wider than it was at first; then the southern edge resolved itself into parallel bars at right angles with the arch; shortly after, the northern edge resolved itself into similar bars, which moved rapidly towards the west; presently the bars at the southern edge of the arch either vanished or blended with the others, and they all glided swiftly by towards the west; the bars gradually became fewer and fewer, until they could be seen only here and there gliding along; and at last the whole arch faded entirely away. During all this time the lights in the north had been shining, and when I retired for the night they were still to be seen.

I have copied this description from notes which I took at the time. I have seen other interesting auroras, but never have seen the arch overhead since. FRANCIS H. ALLEN.

West Roxbury, Mass, June 13.

Concerning the Montville Serpentine.

THE statement made by your correspondent in your issue of June 15, regarding work done by me on the Montville, N.J., serpentine, induces me to add a few additional particulars on the subject. This I am the more inclined to do, since the paper giving the full results of my work is as yet unpublished, but is awaiting its turn in the Government Printing-Office.

The origin of serpentinous rocks, by a process of metasomatosis, from the various members of the pyroxene group, is a matter by no means new to petrographers in general, and has been noted by Dana in the limestone-beds of Westchester County, N.Y., as well as by Emmons and Cross in those of the Leadville region. None of the cases, however, can compare in point of beauty with that at Montville. Here, in a coarsely crystalline, highly magnesian limestone, were originally embedded numerous large and small spheroidal and lenticular masses of a gray or pure white monoclinic pyroxene approaching diopside in composition. These, through a process of metasomatosis commencing on the outer surface, have become converted wholly or in part into a very pure, though highly hydrated, translucent green and light amber-yellow serpentine. In the process of quarrying the limestone for flux, these nodules are thrown out; and from the quarry dump have been gathered samples showing most beautifully every stage of the change, from that in which the serpentine exists as merely a thin coating, to that in which all traces of the diopside have disappeared, and a solid block of compact serpentine alone remains. The nodules vary in size from the fraction of an inch to two or more feet in diameter. I have as yet, however, never seen blocks of the serpentine more than six or eight inches in greatest diameter. The process of change must have been exceedingly slow and gradual, as the line of demarcation is very sharp; so sharp, indeed, that at first glance such an origin as I have attributed appears impossible. On exposure to the weather, the serpentinous coating undergoes a shrinkage, and breaks away from the unchanged nodule almost as clean as the burr from a chestnut. Nodules in the museum collections, which have been freed from their serpentinous coating, have the appearance of some easily soluble substance, like limestone, that has been suspended freely in a dilute acid until all its angles and irregularities of surface have disappeared.

In my paper which is shortly to appear in the Proceedings of the United States National Museum are plates showing the nodules and the transition stages from diopside to serpentine, as shown in thin sections under the microscope. I have gone into considerable detail in my description, not merely on account of the beauty of the resultant serpentine, but because this is an unusually fine illustration of the process of metasomatosis. The beautifully slickensided surfaces, and other indications of the expansive force generated during the process, are also very suggestive.

The readiness with which samples can be procured which show in a single small specimen all stages, from perfectly fresh and unchanged diopside to beautiful compact serpentine, makes the material particularly valuable to teachers. The small size of the serpentine blocks obtainable, together with the invariably fractured condition of the mineral, renders it of practically no importance as an ornamental stone. GEORGE P. MERRILL.

U.S. Nat. Mus., Washington, June 16.

Queries.

33. DIPHTHERIA CARRIED BY TURKEYS. — Referring to the paragraph 'Diphtheria carried by Turkeys,' in *Science* for May 11, I beg to inquire if the disease among barnyard fowls known as 'roup' has been investigated as a germ disease, and its relations with other animal orders (if it have any) made out or sought.

J. T. W.

SCIENCE

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SCIENCE

FRIDAY, JUNE 29, 1888.

AT A MEETING held at the Mansion House, London, on June 8, in support of a scheme for establishing polytechnic institutes in South London, a speech was delivered by Lord Salisbury, in which he pointed out, that, if the law of "the survival of the fittest" is to hold, there must be a rapid improvement in the human race at no distant day. Lord Salisbury, after passing in review the efforts which have been made in London to meet the demand for technical instruction, concluded as follows: "I have only one more word to say, just to call your attention to another aspect of this case, and to commend it to your efforts. We live in a time when men multiply fast, but apparently the means of supporting them do not multiply as rapidly; when there is vehement competition, and occasionally intervals of deep depression. And if you should look more closely, you will find that one cause, at least, of this phenomenon is that man, as the mere owner of muscle, is being edged out by another and more powerful competitor. Merely as an agent of physical force, as the possessor of the power of labor, the steam-engine is a competitor which drives him easily out of the market. And more and more the mere unskilled labor is being made unnecessary by the development of the forces which mechanical science has discovered. And as the world goes on, you must expect this tendency to increase. You must expect mechanical force to become more varied and more powerful and more cheap, and the competition with human arms and limbs to become more hopeless. But there is one region where the machine can never follow the human being, and that is in the exercise of thought. In skill, in cultivated mind, in the power to adapt the processes of thought to the laws of nature, in all that we call 'skilled labor' of the highest kind, — in that man must always have a monopoly, and need fear no encroachment from the competition of the steam-engine. It is to the development of his powers in that respect that the increase in the means of subsistence, and the opening of new paths of self-support, must be found. On all of us, in whatever position we are, is pressing, as one of the most anxious subjects of public care, the discoveries of methods by which the teeming millons of this country shall be able to maintain themselves in a prosperous, decent, and comfortable condition. We cannot find in their unskilled labor a satisfaction of that want. The difficulties are enhanced by the fact that our neighbors in other countries have been sensible of the superiority which skilled education can confer, and have not been slow to take advantage of it. If we will not be left behind in the race, if we desire to find any satisfactory solution for the deepest and the most inscrutable problem of our time, if we wish our complex community and high civilization to be maintained secure from all the dangers which the presence of unfed, unprosperous, untaught millions must bring upon them, we shall do our utmost to give a healthy and a rapid development to the secondary education of the working-classes."

In commenting on this speech, and on the report of the proceedings as given in the *Times*, *Nature* takes occasion to say, "For many a day, as our readers know, we have been urging the necessity for the establishment of a proper system of technical instruction. The subject is one of such pressing importance that we have returned to it again and again, seeking to present it in many different aspects; and Lord Salisbury's speech and the article in the *Times* may be taken as indications that large classes of the community have at last begun to understand that the nation has no time to lose in setting about a task which ought long ago to have been most seriously undertaken. Even if the question had little direct relation with economic interests, it would be for many reasons desirable to secure for manual training a place among our educational methods. Attention has hitherto been too exclusively devoted in schools to such knowledge as may be derived from books. It is necessary, from the strictly educational point of view, that teachers should aim at a wider, more direct, and more practical development of the mental powers of their scholars. But other and even more fundamental interests are also concerned. The leading nations of the world, our rivals in industry and trade, have already perceived the benefits to be secured from a thorough mastery, on the part both of employers and employed, of the principles of science as applied to agricultural and manufacturing processes. The result is, that in many of the best markets, where our supremacy as a trading people was formerly unquestioned, we find ourselves at a disadvantage; and it is certain, that, unless we place ourselves on a level with our competitors, we shall have to pass through some very bitter national experiences. The question is really one of life and death for England. It is a question whether in the near future there are or are not to be sufficient employment and remuneration for the vast and growing masses of her population."

THE MODERN TENDENCY of population to drift from the country to towns and cities is well illustrated by some figures published in a recent number of the *Melbourne Argus*. These figures have attracted considerable attention in Australia, where the tendency is particularly marked in the case of Melbourne, Sydney, and Adelaide. In Melbourne the yearly increase in population has been the greatest, the gain during the past three years varying from nineteen thousand to twenty-two thousand; and this increase is apparently still growing. The population of Melbourne and its suburbs is estimated at 400,000, against 250,000 in 1878. During the same time there has also been an increase in Sydney; and it is believed that this city must now be nearly as large as Melbourne, although with due pride the *Melbourne Argus* expresses its belief that the latter city is destined to be the real capital of Australia. This increase in city population has been at the expense of the country districts. The desertion of work at the gold-fields has tended to depopulate some sections, which population has gravitated toward the large cities. In 1861 Melbourne contained one-fourth of the population of the colony of Victoria; in 1881 this proportion had increased to one-third, and it is now two-fifths; and apparently we may soon see the phenomenon of one-half the people of the colony living in the city, and one-half outside of it. Similar conditions practically are true of Sydney and Adelaide. Melbourne at present contains one-seventh of the entire population of Australia. Whether this drifting from country to city will have any effect on the prosperity of the colony remains yet to be seen.

THE THREE AMERICAS PERMANENT EXHIBITION.

THE heartiness with which both Houses of Congress have dealt with the projectors of the 'Three Americas Permanent Exhibition' that it is proposed to establish in Washington in 1892 as a part of the celebration of the discovery of America by Columbus, insures its success. While the subject was under consideration by the House Committee on Commerce, Major J. W. Powell, director of the United States Geological Survey, was invited to address the committee on the archæological importance of such an exhibition His remarks set forth more forcibly than has been done elsewhere the advancement to this branch of science that is likely to result from such an exhibition, and the importance of securing the material for it at once. The copious extracts given below will be found interesting: —

"The value of great national fairs or expositions has been abundantly shown by the history of such enterprises, alike in America and in Europe. A great national fair is a stupendous object-lesson in industrial civilization.

"The discovery of America is the event which it is designed to celebrate, and its importance is unparalleled in the history of human progress. At that time a continent was found peopled by savages and barbarians, who did not occupy the land, but who were scattered along the water-courses and shores in little tribes far distant from one another. In their ignorance the beautiful earth, with all its potential gifts for civilized man, was but a hunting-ground, a berry-patch, a tobacco-garden, and a battle-field. But the discovery of this new world gave North and South America to the plough, the mine, the workshop, the highway, and the market. A new world was delivered to civilized man as a theatre for new and highly developed industries, and, better than all, as a theatre for new and highly developed institutions, founded upon principles that recognize a wider liberty and more just equality, and a fraternity that embraces a greater scope of imperative duties, than had previously been recognized in the history of man. This great gift to mankind was not the result of accident through the drifting of tempest-tossed sailors from far-off Asia to the golden strands of the West; it was not the gift of chance through the wandering of barbaric Norsemen to the bleak lands of the north-east coast. Civilization discovered America by the light of science. Columbus, a great scholar, a scientific investigator, a man whose insight penetrated to the great secrets of nature in the light of the science of his time, — which was indeed but dim, — by means of one of the grandest scientific inductions in history, accepted the conclusion that the earth is a sphere, and with a sublime faith in scientific inductions he sailed into an unknown sea, inhabited by the monsters of mythology, and beset with the dangers of superstitious credulity, and through this ignorance he sailed away until he discovered the new land; and the inductions of science were verified by the appearance of continents and islands, from which great mountains reared their tops into the heavens. There, too, great lakes were found whose billows were destined to rock the commerce of many peoples, and there great rivers were revealed upon whose turbulent currents the navies of industry now ride. To celebrate the discovery of America by Columbus is to celebrate the greatest event of human history.

"But it is not my task to speak of the value to civilization of the proposed exposition, nor of the importance of the event which it is designed to celebrate; nor even to show that such a celebration would be signally appropriate to the people who are the chief beneficiaries of that great scientific discovery, but simply to set forth the extent to which the great exposition may be made interesting and instructive to the people by making an exhibit of the archæology of the New World.

"The *débris* of forgotten culture of the world was long held to be refuse, unsightly and loathsome; but the time has arrived when this refuse of uncultured man is esteemed by the enlightened man as the priceless relics of antiquity. The ruins of an ancient city that were worthless a few decades ago, are, by the processes of modern investigation into the history and growth of human culture, transformed into values that nations covet; and civilized men are everywhere throughout the world engaged in exhuming from the ruins of ancient cities the treasures of history. Societies are organized for the collection of the material, and colleges and universities are engaged in its investigation, and the libraries of the world are daily enriched with the volumes of this new learning.

"The events of history that are recorded by contemporaneous writers are colored with prejudice and blurred with ignorance; but the records that are preserved in the imperishable works of man are not tainted with baneful inspiration and false statement, but tell the truth, and nothing but the truth. In the past, history was the theme for literary exploration; in the present, history is the theme of profound investigation; and history has become a science because it is founded upon archæology. It is thus that the ruins of a temple, a tower buried in its own *débris*, an inscription on a rock, a bronze spear, a stone knife, or a potsherd, has a value. A mound or a monument is a volume of history, and a ruined city a great library.

"The people who were found in America, the tribes of savages and barbarians, are rapidly being absorbed among the people of civilization. Their history was written; their artisans, their warriors, their statesmen, and their poets are forgotten; but the vestiges of their history, their archæologic records, are widely scattered. They are found buried in ruined towns and villages; they are covered by innumerable mounds of earth that were built as sites for their council-houses, as places for worship, and as cemeteries for their dead; they are found in countless stone-walled graves; they are found in innumerable refuse-heaps, the *débris* of the kitchens of the savage man; they are found in every ploughed field and on every hillside, and scattered over every mountain; and from these sources they must be taken, if we are to reconstruct the ancient history of America. But every dust-laden breeze buries them deeper, every storm of sand serves to hide them more effectually; the furrowing of every field is an agency for their destruction; the working of every road, the construction of every railway, the erection of every building, makes these relics rarer and more valuable; and ere they are lost I beg they may be secured. The whole civilized world is interested in their collection and preservation, and the people of other lands are gathering and carrying them away by cargoes to enrich the museums and the great universities and splendid capitals of Europe; while in America only a few quiet students have become interested in these materials of American history, and until within a few years we have been almost wholly neglectful of things which by time are becoming more and more valuable.

"The wealth and variety of the materials of American history are but little appreciated. The people who inhabited the American continent before its discovery were not all of one race, but of many. In North America alone there were more than seventy-five distinct stocks, having radically distinct languages and mythologies, having independent and diverse institutions, and having diverse and multifarious arts. At the north we have the igloo-dwellers that live by the shores of the frozen seas; farther to the south we have races occupying dwellings made of forest timber; other races wove their habitations of reeds; others built their towns of the clay of mother-earth; and others erected their buildings of stones quarried from the cliffs; while still others hewed themselves habitations in the solid rock. Some dwelt on towering and almost inaccessible cliffs, while other towns were erected among the crags and cinders of extinct volcanoes. Some races were hunters, other races were fishermen, still other races were agriculturists. Some races worshipped the sun and moon and stars, and the gods of the cardinal points; other races made the mountains and the rivers the object of their principal worship; and all worshipped strange mythologic beasts. All of the tribes were organized into bodies politic as bodies of kindred, but the method of organization was multifarious. Many tongues were spoken: harsh consonantal and guttural languages were found in the cold climate of the extreme north and south, vocalic and musical languages were found in the sunny lands of the middle zones. Everywhere the tribes had learned to use picture-writing, and to record events with pictures of men and beasts and many conventional signs. They made tools and implements of stone and bone and shell and horn and wood. They made canoes and boats of bark and logs, they made rafts and basket-boats of weeds, and they made kayaks of skins; and in such crafts they navigated the rivers, the lakes, and the seas. The relics of all these mythologies, religions, institutions, languages, and arts, must be recovered, if we are to preserve the ancient history of America; and the work must be done soon, or they will be lost.

"It is possible to make the four-hundredth anniversary of the discovery of America an occasion to collect and preserve the ancient history of the country, to gather the materials of its archæology, and to put them into one grand international museum at the seat of government of the United States. No other enterprise in connection with such an American exposition would interest the people more, and no other would be more instructive; and it is proposed or suggested by the Citizens' Committee that a great archæologic exhibit be made, and that each nation in North, Central, and South America be invited to contribute its quota to this great museum. The erection of an appropriate building for this purpose, indestructible by fire, and of sufficient magnitude for the instalment of so great a collection, would cost about five hundred thousand dollars. The archæologic materials to be found within the territory of the United States are in part, but only in small part, collected, and now in the National Museum; and the time is all too short for the completion of this collection, yet by beginning soon it might be well done.

"Such, in brief, is the plan which I was requested to present to you by the Citizens' Committee. It is no less than to collect and put on record for future generations the priceless records that constitute the history of all the native American races. If this can be done, it will be a monument to these native peoples, erected by the invading and conquering and civilizing nations, worthy of Aryan power, and worthy of Aryan culture."

WHEAT-CULTIVATION.

IN the last number of the Journal of the Royal Agricultural Society of England, the most interesting sections are those bearing upon wheat-cultivation. A paper upon the condition of wheat-growing in India, by Dr. George Watt, is followed by an article by Mr. W. E. Bear upon the Indian wheat trade, and in this connection is given an interesting account of modern improvements in corn-milling machinery. These papers throw considerable light upon the difficulties under which the English wheat-grower is struggling, and are commented on by Mr. Wrightington in a recent number of *Nature*.

Dr. Watt and Mr. Bear show the extraordinary extent of the wheat-producing area of the Indian Empire, and the rapidity with which this vast field is being opened up. With reference to the latter point, men in middle life are scarcely likely to realize the fact that in 1853 there were in all only 20½ miles of railway in India, that in 1873 there were 5,695 miles of railway, while in 1887 there were 13,386 miles. Telegraphic communication with India was first opened in 1865, and the opening of the Suez Canal in 1869 was scarcely of less importance in developing her trade, first by shortening the passage, and second by mitigating the risk from wheat-weevil. Another agency has been the development of irrigation-works. We read that "only" 30,000,000 acres have up to date been artificially irrigated; but the appropriateness of the qualifying adverb is rendered evident when it is employed in contrast with the total area of 200,000,000 acres of cultivated ground, and the vast tract of 868,314 square miles which include British India. The normal area under wheat is 26,000,000 acres, and the degree to which this area is likely to be increased depends entirely upon demand and price. Dr. Watt informs us that the Indian cultivator is at all times ready to adapt his courses of cropping to circumstances, and that he will increase or abandon the cultivation of wheat, cotton, or any other crop according to its comparative profitableness.

Dr. Watt comes to the conclusion that the Indian wheat trade up to the present time is a perfectly natural one. "The people are exporting only what they specially cultivate for that purpose. The moment better profits can be realized on another crop, they will turn from wheat, without being in the least degree incommoded." If this is the case, the English farmer may well look with envy upon his Indian brother, as he is in the unfortunate position of being compelled to carry on wheat-growing from sheer inability to find a substitute for it in his agricultural economy. Natural though the course of the ryot may be from his point of view, the actual bounty upon wheat, or what amounts to a bounty, consequent upon the fall in value of the rupee, can scarcely be described as natural. This great advantage to the Indian cultivator is clearly brought out by Mr. Bear by the following considerations: First, the Indian ryot gets as much for a quarter of his wheat now as he obtained in 1872. He gets as many rupees, and his rupees are worth as much to him as they were then. In 1871-72 the average exchange value of the rupee was 1s. 11.12d., whereas recently it has been under 1s. 5d. The price of No. 2 club wheat in Calcutta in 1872 averaged only 2rs. 3a. 1p. per maund, whereas it has for some time past been over 2rs. 10a. Taking 16rs. per quarter (6 maunds) as the price for both periods, then reckoning the exchange value of the rupee for both periods, it is clear that the exchange value of 16rs. in 1872 was equal to 30s. 8d. per quarter, whereas the exchange value of the same sum in 1888 is only 22s. 8d. The fact is that the Indian ryot gets as much for a quarter of wheat now as he did in 1872, in spite of the fall in prices. He gets as many rupees, and his rupees are worth as much to him. This seems to settle the question as to the encouragement given to the ryot as a competitor in wheat-growing with the English farmer. Another point, in all respects discouraging to the cultivation of wheat in England, is found in the complete revolution during the last ten years in corn-milling machinery described by Mr. W. Proctor Baker of Bristol. There has been, in fact, not a mere substitution of one machine for another, or of one series of machines for another, but there has been a change of the principle and mode of procedure. The old system of 'low grinding' by mill-stones, so well calculated for producing flour from soft, tender wheats, such as are produced in England, has been entirely superseded by the Hungarian and American 'gradual reduction' process by 'roller mills.' Not only does this system require the wheat to be dry, hard, and brittle, so as to secure the requisite cracking and gradual reduction, but any thing in the form of a soft or moist wheat is most injurious to the machinery and the products. It rolls into a paste, steam is generated, and the flour works into balls, becomes attached to the rollers, turns sour, and, in fact, throws the entire process out of gear. "It is because of these troubles that owners of mills on a large scale will not employ native wheats in damp seasons. No concession of price is sufficient inducement to them to risk the disorganization of the mill, and probable loss of reputation, by turning out inferior or irregular flour." There are, however, two modes in which these wheats may be used, — first, by submitting them to an artificial drying process; and, second, by mixing them with some description of very brittle wheat, and allowing the mixture to lie for some weeks, until the brittle wheat absorbs some of the moisture of the native wheat, to the mutual advantage of both.

THE MARINE BIOLOGICAL LABORATORY.

THE new laboratory is at Wood's Holl, Mass. A convenient site has been secured close to the shore and to the laboratories of the United States Fish Commission. The laboratory building consists of two stories; the lower story for the use of students receiving instruction, the upper story exclusively for investigators. The laboratory will have boats, dredges, and other collecting apparatus; it will also be supplied with running sea-water, with alcohol and other re-agents, glassware, microtomes, aquaria, etc., a limited number of microscopes for students' use, and a small reference library.

Dr. C. O. Whitman, the distinguished embryologist, has accepted the directorship; and Mr. B. H. Van Vleck, who has had greater experience than any one else in this country in the management of summer seaside biological schools, has been appointed instructor. Under these very competent officers, the laboratory will attract probably more persons than can find accommodation; nevertheless it remains a matter of regret that the announcement of the opening of the laboratory has been so much delayed, owing, we understand, to some unavoidable difficulties in completing the preliminary arrangements.

The laboratory for students will be opened on Tuesday, July 17, at 9 A.M., for a systematic course of six weeks in zoölogy. By permission of the director, students may continue their work until Sept. 20 without additional payment. Microscopes, glass-ware, etc., will be supplied without extra charge except for breakage. Hand lenses, dissecting instruments, drawing materials, etc., may be bought at cost in the laboratory. It is desired that students owning microscopes should bring them.

The fee for this course is twenty-five dollars. The number of students will be limited to twenty-five.

The laboratory for investigators will be opened on July 10, and will be closed on Sept. 22. It will be equipped as fully as the means permit. Microscopes will not be provided, but it is believed that investigators will find most of their indispensable wants satisfied. The fee for an investigator's table will be fifty dollars for the present season.

Rooms accommodating two persons may be obtained near the laboratory at prices varying from three to four dollars a week, and board from four and a half to seven dollars. Applications for places in the laboratory should be made immediately to the secretary of the Marine Biological Laboratory, Nahant, Mass.

Wood's Holl, owing to the richness of the marine life in the neighboring waters, offers exceptional advantages. It is situated on the north shore of Vineyard Sound, at the entrance to Buzzard's Bay, and may be reached by the Old Colony Railroad (two hours and a half from Boston), or by rail and boat from Fall River and New Bedford.

The new laboratory is intended to continue and extend the work of the laboratory at Annisquam, carried on for six years by the Woman's Education Association, with the co-operation of the Boston Society of Natural History.

SCIENTIFIC NEWS IN WASHINGTON.

A New Building in the National Museum; more than Twelve Thousand Accessions made to the Museum since 1882, and nearly Seven and One-Half Million New Entries made in its Catalogues; Hundreds of Thousands of Interesting Specimens yet unpacked; Exhibits for which there is not even Storage-Room. — How the Cholera was spread in Japan in 1886. — The Proper Treatment of Inebriety as a Disease. — More about the Proposed Vacuum Air-Ship.

The Proposed New Building for the National Museum.

THE Senate Committee on the Library has reported favorably a bill to provide for the erection of an additional fire-proof building for the use of the National Museum. The appropriation made for this purpose is $500,000, and the new building is to cover an area of 300 feet square, and to consist of two stories and basement. The site of the building is to be to the west of the Smithsonian Institution, flanking it on that side as the present building does upon the east. The present building contains about 80,000 square feet of floor-space available for exhibition and storage. The building proposed will contain about 220,000 square feet. The amount of room for offices and laboratories will be about the same in each. The net area in the new building available for exhibitions, storage, and office-rooms, as estimated, will be between five and six acres.

The cost of the present National Museum building was $315,400, and that cost was less than that of any similar building in existence in this country. The proposed structure can now be erected at proportionately smaller cost, responsible builders having offered to build it for $473,000. Plans of the interior and elevations of the proposed new building were submitted with the report of the committee.

To show the necessity of providing at once more extensive accommodations for the National Museum, the following interesting extracts from a letter written to the committee by Prof. S. P. Langley, secretary of the Smithsonian Institution, June 7, are given: —

"Since the erection of the present museum building there have been more than 12,000 accessions to the collections, chiefly by gifts. From the year 1859 to 1880 the accessions numbered 8,475. It is thus evident that within the last eight years the number of accessions has been half as large again as during the previous twenty-one.

"Many of the more recent accessions are of very great extent, as, for instance, the bequest of the late Isaac Lea of Philadelphia, which contains 20,000 specimens of shells, besides minerals and other objects; the Jeffries collection of fossil and recent shells of Europe, including 40,000 specimens; the Stearns collection of mollusks, numbering 100,000 specimens; the Riley collection of insects, containing 150,000 specimens; the Catlin collection of Indian paintings, about 500 in number; the collection of the American Institute of Mining Engineers, for the transportation of which to Washington several freight-cars were required.

"There are also the extensive collections obtained at the Fisheries Exhibitions at Berlin and London and at the close of the New Orleans Cotton Centennial; the Shepard collection of meteorites; the Wilson collection of archæological objects (more than 12,000 specimens); the Lorillard collection of Central American antiquities; and very many others nearly as extensive. In addition to these are the annual accretions from the work of the United States Fish Commission, the United States Geological Survey, and the Bureau of Ethnology, as well as the contributions from several expeditions of the government, from army and navy officers, and from other government officials. These are very extensive, and are yearly increasing in bulk and value.

"In the Armory Building are stored many hundreds of boxes of valuable material which we have not room to unpack, and the great vaults under the Smithsonian building and many of the attic and tower rooms are similarly occupied.

"For several important departments of the museum no exhibition space whatever is available, and no portion of the collection can be publicly displayed. Indeed, the growth of many of the departments is in large measure prevented by the fact that we have no room for additional exhibition-cases, or even for storage. Many valuable collections elsewhere than in Washington are at the service of the museum, but we have no space for their reception.

"At the close of the last fiscal year (June 30, 1887) a very careful estimate showed that the collections were sixteen times as great in number of specimens as in the year 1882.

"The museum is growing, as it is fitting that the national museum of a great country should grow; and it is not only necessary to care for what is already here, but to provide for the reception and display of what is certain to be placed in our hands within the next few years.

"The present museum building is not more than large enough for the ethnological and technological material already available. The proposed new building will afford accommodation for the natural-history collections, which are at present very inadequately housed. For instance, the amount of space assigned to the collection of mammals is about 6,500 feet. At least double that amount of space will be needed to accommodate the material now on hand as soon as the taxidermists of the museum shall have been able to prepare it for exhibition, it being our desire to have mounted groups, similar to the buffalo family recently finished, in order to preserve for future generations representations of the large quadrupeds native to this continent, which are on the verge of extinction.

"The collection of birds, which, so far as North America is concerned, is the finest in the world, is very inadequately shown, and requires double the case-room now available.

"The collection of mollusks, which is one of the most complete in the world, and contains more than 450,000 specimens, is at present almost entirely unprovided for.

"The collection of insects, which, though smaller, is, so far as North America is concerned, equally perfect, is also practically without any exhibition space. And so I might continue.

"It should be borne in mind that under the roofs of the Smithsonian and new museum buildings are grouped together collections which in London, Paris, or any other of the European capitals, are provided for in a group of museums, for the accommodation of which a much larger number of equally commodious buildings is found needful."

Causes of the Cholera Epidemic in Japan in 1886.

The *Marine Hospital Abstract of Sanitary Reports* for last Saturday contains extracts from a Japanese official publication on the cholera in that country in 1886. It spread over the whole empire, there being 155,574 cases, among which 110,086 were fatal. There were only seventeen days in the whole year in which no cases were reported. The following paragraphs from this report are interesting, because they show, what has been so often shown before, the effect of bad sanitary conditions upon the spread of an epidemic: —

"As to the cause of its outbreak and propagation, accurate evidence is wanting; it is an undeniable fact, however, that it sprang and was propagated from the widely spread germs of the disease which had lain dormant in Osaka the preceding year, there being no trace of a fresh introduction. Osaka, in the autumn of the preceding year, had been invaded by the disease from Nagasaki; but after some thirty days of prevalence the epidemic gradually declined with the approach of the colder season, though it did not then entirely disappear. One or two cases kept occurring continually over into the next year, until, on the 2d of January, there were five cases reported in the western and southern districts of the city and in the ku of Sakai. On the 3d, five more cases were reported in the three ku of the west, south, and north, and the ku of Sakai. From this time forward, the number of cases gradually increased until the approach of the warmer season, toward the end of April, when it had spread all over the city, where it raged up to the end of October. During the epidemic, there were ninety-nine days in which the daily number of cases reported was over one hundred, and four days when there were two hundred. Indeed, it was the most severe epidemic ever known in Osaka.

"The situation of Osaka is such that it undoubtedly favors the propagation of an epidemic; for the water of the Yodo River, being conducted through the city by canals in various directions, besides furnishing a convenient roadway for transportation and water traffic, also receives the contents of the drains of the city, while at the same time it supplies the city with drinking-water.

"The wells, keeping the same level with the canals, freely communicate with each other, and thus the drinking-water of the city is more or less mingled with the water of the drains. Such, then, being the situation of Osaka, when an epidemic appears, the same convenience for the transportation of goods furnishes an easy medium for the propagation of disease. It is not strange, then, that since the tenth year of Meiji (1877), whenever an epidemic prevails, the city has been a centre of the epidemic. Moreover, in the preceding year there was much rain after the spring, until finally, in June, the Yodo River overflowed its banks, inundating the streets and houses. Hence the city was rendered very filthy, in consequence of which the concealed germs found a favorable nidus, from which the disease appeared with the return of the warm weather, and finally ravaged the whole city. It is also to be borne in mind, that, as Osaka is the commercial centre of Japan, and has free communication in every direction, it is likely to become the cradle of epidemics, and therefore whatever has made its appearance in various other localities has had its origin directly or indirectly in Osaka."

Drunkenness as a Disease.

Dr. Godding, superintendent of the Government Insane-Asylum in Washington, has written a letter to one of the committees of Congress, in which, while showing that it would be unwise to confine inebriates with insane persons, he makes the following interesting remarks: —

"Inebriety as a disease is distinct from insanity. Inebriates resent being placed with the insane; nor are the insane, as a rule, proud of them as associates. Insane from the poison of drink, as they undoubtedly are while the liquor is in them, they now and then get committed to hospitals for the insane, and in their detention during convalescence they afford interesting though unprofitable psychological studies. Dissolute in habit, and idle in life, they are uncomfortable from the start. They are usually fault-finding and impatient at their detention, denouncing every body and every thing about them. When quiet and seemingly at ease in their lot, they are studying how to smuggle in whiskey, or effect an escape. In them moral honesty and generous impulses are sadly wanting, and a condition of settled discontent characterizes the enforced abstinence of their hospital life. What they need is occupation and prolonged treatment in an industrial home, where they can be kept at work at enforced labor under the supervision of a judicious physician. As a rule, confinement in idleness does them little or no good."

The Vacuum Air-Ship again.

The House Committee on Ventilation and Acoustics recommends the passage of the bill, referred to in *Science* recently, making an appropriation to build a vacuum air-ship. The conditions of the grant of seventy-five thousand dollars are, that a like sum shall already have been spent upon the construction of the air-ship, and that the secretary of the navy, after an investigation, with the aid of a board of engineers, into the plan of the construction of the proposed air-ship, and into the principle upon which it is proposed practically to operate it, shall be satisfied that there is reason to believe the air-ship will prove a success in attaining the ends for which it was designed. The last payment is to be made after a successful trial trip has been made. Dr. A. de Bausset, the inventor of this vacuum air-ship, proposes to make it in the form of a tube, air-tight, and cone-shaped at the ends, of steel of sufficient strength to withstand the pressure of the circumambient air when a vacuum has been produced by pumping all the inside air out of the ship. He says of his plan, "Steel $\frac{1}{44}$ of an inch in thickness has been tested, and has been proven capable of sustaining a pressure double that of the atmosphere. A cylinder 46 yards in diameter, with a total length of 218 yards, if made of this steel, will weigh 260,680 pounds: the volume of air contained in it weighs 719,709 pounds, giving an ascensional force of 459,029 pounds if the vacuum were complete." He relies upon an electric motor and a compound exhaust-screw to propel and guide the vessel when afloat.

Mr. George W. Melville, chief of the Bureau of Steam-Engineering, of the Navy Department, has written to Dr. de Bausset as follows: "I have the honor to inform you that I have looked over many of your computations, and find them correct, and also that the principle and theory of your aeroplane are in the main correct; but I have not sufficient time to properly study the details of construction of the vessel, which would be necessary in order to pass judgment upon it."

ELECTRICAL SCIENCE.

Tests of the Tudor Accumulator.

PROFESSOR KOHLRAUSCH has carried out some experiments on the Tudor accumulator which are not uninteresting. The following is part of the data obtained: —

Weight of plates	29.3 lbs.
Surface of four positive plates	1.29 sq. ft.
Volume of acid	6 pts.
Specific gravity, charged	1.147
Normal charge rate	5 ampères
Normal discharge rate	6.5 "
Internal resistance, charged	.015 ohms
" " discharged	.02 "
Capacity per pound	1.6 ampère-hours

The two cells that were tested had been in continuous use from November, 1881, to December, 1887. During the tests they were charged and discharged thirty-four times, and between charge and discharge a period of fifteen hours was allowed to elapse. Six experiments showed a total capacity of 47 ampère-hours, an efficiency of 82.4 per cent for energy, with a drop of 12.6 per cent in electro-motive force. After this several tests of an abnormal character were made. The cells were charged, and then left alone for various periods of time. There was a loss of about 7 ampère-hours at first, but after this there was no further loss in a week. When charged with a current of 8 ampères, and discharged at 10 ampères, the total efficiency was 64.7 per cent. When discharged through a constant resistance, with a current beginning at 50 ampères, they gave 23.5 ampère-hours and 40.5 watt-hours; the current falling from 50 ampères at the start to 40 ampères at the close, and the electro-motive force from 1.8 volts to 1.3 volts. They were then recharged, and discharged with 90 ampères at the commencement and 62 ampères at the end. After this enormous strain, the cells, when recharged, gave their normal discharge just as at first.

Lastly, they were run down for four days, starting at 1 ampère, until the electro-motive force had fallen to 0.2 volts, and the specific gravity of the acid to 1.1. The cells were then recharged, and on discharge gave 46.8 ampère-hours, with a total efficiency of 80 per cent. The tests show a length of life of the cell, and a power of resisting abnormal discharge and discharge rates, that is in advance of any thing yet recorded. The storage capacity is, however, low as compared with more recent cells. As, however, it is in length of life and the allowing of heavy discharge rate that the ordinary battery is mainly deficient, these experiments encourage us to believe that in a few more years storage-batteries will have reached the point where their application to traction in cities will be almost universal, and where they will make the distribution of electricity for lighting on a large scale better able to compete in price with gas.

THE MAGNETIZATION OF WATCHES. — With the rapid introduction of dynamo-electric machines and electric motors, there has arisen an inconvenience that is not only felt by those who work in electric-lighting stations, but which is likely to affect the public generally. Steel is usually used in the quick-moving parts of watches; and when this, for any reason, gets in a strong magnetic field, it becomes magnetized, greatly changing the rate of the watch, and making it irregular. It is possible to demagnetize a watch that is affected in this way; but it is a troublesome process, and is not a permanent safeguard. To avoid this trouble, non-magnetic balances are being rapidly introduced; and, although those made at present are more costly than steel, yet they add but little to the total cost of the watch, and make it reliable under all conditions. Probably the first to make an alloy that would possess the properties of hardness and elasticity without being magnetic, was Paillard. He has described several alloys that may be used; and watches made with balance-wheels and hair springs of these alloys have stood the most severe tests, with success. The most important component in the alloys is palladium. The other components are copper and iron, for one of the alloys; viz.: —

Palladium	50 to 75 parts
Copper	20 " 30 "
Iron	5 " 20 "

Another alloy is, —

Palladium	65 to 75 parts
Copper	15 " 25 "
Nickel	1 " 5 "
Gold	1 " 2½ "
Platinum	½ " 2 "
Silver	2 " 10 "
Steel	1 " 5 "

These alloys, especially the latter, are almost free from magnetic properties. Balances that are to be compensated for temperature are either made of two segments of alloys of different compositions, having different rates of expansion; or the segments are one of alloy, the other of silver. Since attention has been called to Paillard's methods, quite a number of manufacturers in this country and England have experimented on the subject, and are now making non-magnetic watches; and it is probable that at an early day the majority of the watches sold will be made to resist the action of magnetic fields.

CONDUCTIVITY OF A VACUUM. — M. Foeppl has experimented on the conductivity of a vacuum by an ingenious method. He made an induction-coil whose secondary circuit consisted of a glass tube 7 millimetres external diameter, 4.2 millimetres internal diameter. The ends of this coil were connected to a second coil so arranged as to form a galvanometer, within which was a magnet suspended by a cocoon-fibre. The glass tube forming the secondary circuit was coiled in two layers of 18 turns: the primary coil was 24 centimetres long, and was composed of twelve layers of seventy-two turns of wire. With a current of 22 ampères in the primary, making and breaking the circuit, M. Foeppl could not discover any deflection of the needle when there was a vacuum in the secondary tube, even when the degree of rarefaction was changed through a somewhat wide range. He calculates from his experiments that the resistance of such vacuums as he used could not be less than 3×10^6 times that of pure copper. This experiment bears directly on the question as to whether a perfect vacuum would be a perfect conductor or a perfect insulator, since the effect of the electrodes used to introduce the current into vacuum tubes is avoided. While it has, to within a short time, been admitted that a tube in which there is a very perfect vacuum will not admit the passage of electricity, it has been held by some that the result is due to an enormous resistance at the surface of the electrodes, not in the vacuum itself. This experiment disproves this view; at least, for the degrees of rarefaction employed. The wonderful influence of light on electric discharges that is being now investigated by so many experimenters would possibly have influenced the results of M. Foeppl's experiments, if they had been tried in the presence of some intense source of light.

WINDMILLS FOR ELECTRIC-LIGHTING. — Some time ago the possibilities of windmills for domestic electric-lighting were mentioned in this journal, and lately the experiment has been practically tried. Professor Blyth read before the Glasgow Philosophical Society a paper on the subject, in which he describes an experiment which he made last summer, — the lighting of a cottage in which he spent his vacation by a dynamo driven by a windmill, and charging a storage-battery. The windmill used was an old-fashioned type, with four arms at right angles to each other, each of them thirteen feet long. There was no especial regulating-device. The dynamo was belted directly to the fly-wheel of the mill, and charged twelve cells of storage-battery which supplied the incandescent lamps in the cottage. Professor Blyth had never used more than ten lamps at once, but he could have used more. With a good breeze, enough electricity could be stored in half a day to supply light for four evenings of three or four hours each. The lamps used were of 8-candle power. When charging, the current passed through a cut-out that would disconnect them from the dynamo when it ran below a certain speed: so the windmill could be allowed to run all the time, charging the battery when the wind happened to be strong enough. The current had been used to run a light turning-lathe, and Professor Blyth had begun to make a light carriage to be run by the stored electricity. The paper opens to us a field for ingenuity, comfort, and amusement in our homes. Windmills much superior to that described can be readily purchased, a small dynamo can be bought or built at little cost, and storage-batteries can be purchased or made. With them we could light our house economically; our light would be better, cooler, and healthier than gas or coal-oil lamps; while the current could be utilized for running fans, sewing-machines, etc. Indeed, to the average American, with some spare time and some small ingenuity, the amusement and instruction of such a plant would more than pay for its expense.

HEALTH MATTERS.

Cremation of Garbage.

THE important subject of garbage-cremation, and the recent advances made in this method of disposing of this waste material, are admirably summed up in the following extract from the *Sanitary News*: —

An indorsement of the method of disposing of kitchen waste, recently inaugurated in Chicago, was pronounced before the section on State medicine at the Cincinnati meeting of the American Medical Association, Tuesday, May 8, by Dr. J. Berrien Lindsley of Nashville, Tenn. Dr. Lindsley's paper was an exhaustive *résumé* of the present status of garbage-cremation. He gave two or three examples showing the great quantity and variety of polluting material occurring without pause in the limits of a city.

Baltimore, August, 1887, estimated by police census, had a population of 437,155. The amount of night-soil delivered at the dumps for the year ending Dec. 31, 1887, was 51,107 loads, or 10,221,400 gallons. Probably more than half the inhabitants use water-closets which carry off an equal amount.

The dead animals, etc., removed during the same year, were: —

Total number of dead animals	25,249
" " " fowls	9,079
" " " fish	23,574
" " cart-loads of dead fish, vegetable and other offal removed from various docks	1,067
" " pounds of decayed meat condemned	1,495
" " dozens of eggs condemned	607

Richmond, population 100,000. The report of contractor for removal of garbage or kitchen refuse, year 1887, shows total number of loads carried off 2,680, equal to 72,200 bushels.

Memphis, population 62,335. Number of loads of garbage removed in 1887 was 29,120.

These examples were selected at random. To keep the city clean is the principal work of municipal governments, and requires more expenditure of money than all other objects combined, excepting schools and police.

The city filth naturally falls into four main subdivisions, — street-sweepings, night-soil, dead animals, and garbage. The latter alone concerns us at present. The definition of garbage is refuse animal and vegetable matter from the kitchen. Every household is a workshop for garbage. In the country and small towns many a family is poisoned by the careless accumulation of the same near the well or sleeping-apartment. In small towns it is mostly got rid of by feeding to swine and cows; in larger communities, by carting off and polluting harbors or rivers.

In the second report of the State Board of Health of Maine, 1887, the secretary, Dr. A. G. Young, says, "Of the several methods which have hitherto been in use (for removing garbage), it may be said that none of them are free from serious objections. If the garbage is carried any considerable distance into the country, its transportation is attended with considerable cost. If buried, it still often remains a nuisance by contaminating the air or polluting the water in the neighborhood. If utilized in part as food for swine or cows, there is sometimes inflicted upon the community which sends it forth a retributive penalty in the shape of an unwholesome milk and meat supply.

"In the case of a seaboard town, if it is sent seaward, the garbage may depart from the place of its origin never to return, but in large part it is strewn along other coasts.

"The great desideratum has seemed to be some method which would not require a costly transportation of the garbage, or necessitate the defilement of our seashores, but which would radically and ultimately destroy it near the place where it is produced.

"Within the last few years, a new method of disposing of garbage has been written about and talked about, and to a considerable extent put into operation and practically tested. It is the method of destroying or cremating garbage by means of furnaces specially constructed for that purpose. Where these garbage-furnaces have been put into use, there is pretty uniform consensus of testimony as to their success. When rightly built, they have done their work satisfactorily, and generally at considerably less expense than had hitherto been incurred in disposing of the garbage otherwise. But little or no cost is incurred for fuel to run the furnace, as the garbage is dried more or less before it is burned, and is made to consume itself. The cost of labor in attending the furnace is not great, and generally there are no unpleasant odors given off in the process of burning.

"This method has not been much used in this country, but in Europe, and particularly in England, it has been extensively employed. Dr. O. A. Horr, a member of this board, who has lately returned from Europe, made special inquiry in regard to garbage-cremation in England, and all he could learn convinced him that this system is a success in that country. The garbage-furnaces in many of their towns have been in operation many years, and, in conversation with the health-officer of the city of London, he learned that there are now forty-five of the English towns which make use of this garbage-destruction.

"In this country, so far as I know, the experiment of destroying garbage by means of a furnace constructed specially for that purpose was first tried on Governor's Island, New York harbor. A description of this garbage-cremator was given in the *Sanitary Engineer* of Aug. 13, 1885, by Lieutenant Reilly, at this time acting assistant quartermaster, U. S. A., at that post." This description is reproduced in the report above quoted.

In the twelfth volume of 'Public Health,' containing the reports and papers presented to the American Public Health Association, at the Toronto meeting, October, 1886, may be found a paper by Dr. George Baird of Wheeling, giving an account not only of the destruction of garbage, but also of night-soil, by means of a furnace contrived by M. V. Smith, M.E., Bissell's Block, Pittsburgh, Penn. Dr. Baird is brief, and has "only tried to furnish proof of its capacity to solve a long-tried problem in the government of our cities and large towns."

The city authorities of Wheeling were stimulated to action by those of Bellaire, O., on the opposite side of the river, but in close proximity. The dumping of night-soil and garbage from Wheeling into the Ohio River had become an intolerable nuisance to the inhabitants of Bellaire living just below. No alternative remained but to abate the nuisance. A similar alternative will soon be forced upon many of our riparian cities and towns. Law will decide that rivers do not belong to those who happen to dwell near the source, but equally to all below, and that the upper few have no right to deposit their filth in floating columns upon the lower many.

In the 'Report on the Sanitary State of Montreal for the Year 1886,' will be found an interesting narrative in this connection, giving instructive details as to cost, showing the extent of the work to be done and the complete success of the refuse-crematories, and also of the night-soil crematories. It thus appears that Wheeling and Montreal are the pioneer cities in arousing public attention to the cremation of garbage and night-soil.

Dr. Lindsley then sketches the later developments in the new method of destruction and sanitation by fire.

"Other cities," he says, "are taking hold of the experiment with much enthusiasm. *The Sanitary News* of Nov. 19, 1887, states that at Des Moines, Io., a small Engle furnace is in experimental use, and is working very satisfactorily. At Pittsburgh a Rider furnace had just commenced its service. In Chicago a Mann furnace was being constructed.

"In the same valuable journal, March 17, 1888, may be found a full description of the Chicago garbage-crematory, from which a duplicate of the plant could be built if desired.

"On April 14 it reports that the said crematory is doing good service in disposing of about fifty tons of material a day. *The Sanitary News* of March 10, 1888, reports the success of the disposal of garbage by cremation at Milwaukee.

"All who are concerned in this important subject will look forward with great interest to a paper on cremation, to be read at the Milwaukee meeting of the American Public Health Association in November next by Oscar C. De Wolf, M.D., the eminent health-commissioner of Chicago.

"We have seen how very recent is the resort to cremation for getting rid of garbage and other refuse in America, and it may with truth be claimed that Mr. J. M. Keating of Memphis, familiar with epidemics, first set this ball in motion. At the Indianapolis meeting of the American Public Health Association, October, 1882, he presented a paper on 'The Cremation of Excreta and Household Refuse.' He closes the paper thus: 'There is no real safety save by cremation. Yankee ingenuity, once directed in this channel, will doubtless be equal to the emergency, and provide just the kind of cheap furnace or stove necessary for the purpose. By this means, and this alone, can the ultimate of sanitation be realized.'

"Already, in 1879, Mr. Keating had presented his views on this subject through the New York *Herald*, and with the indorsement of that influential paper. In the American Public Health Association, however, he had a deeply interested auditory of experts, and his views attracted much attention. He was induced by many of its active members to prepare an elaborate paper for its meeting at St. Louis, October, 1884, which was published under the title, 'The Ultimate of Sanitation by Fire.' This is probably the most complete and thorough monograph on the subject in the English language. It was widely circulated in the volumes of the American Public Health Association and other channels.

"Individually, I subscribe to the principles and practical conclusions maintained and explained by Mr. Keating, and feel quite confident that in a few years Yankee inventive ingenuity will provide in great perfection the apparatus necessary for daily and cheap use.

"On this occasion I have confined myself to the cremation of garbage, because I am convinced that it will speedily come into use throughout America with like rapidity as has electric-lighting, and will pave the way for a wider and more perfect application of sanitation by fire."

Milk.

Dr. Parkes writes to the *British Medical Journal* as follows: "Whilst not denying that the tubercular virus may find other means of reaching the digestive tract than through unboiled cow's milk, it appears to me that there are no sufficient safeguards in the management of town dairies to warrant us in assuming that milk from cows in an advanced stage of tuberculosis has no chance of being mixed with the milk of other healthy cows. In every dairy of any size there will probably be tubercular cows, some of them, perhaps, with tubercular deposits in the udders; and, as it is the common custom with dairymen to mix together the milk yielded by different cows, it is not too much to assume that tubercle bacilli may be widely distributed in the milk-supply of any town. It has been said that the tuberculosis of cattle is not the same disease as the tuberculosis of man, and that the absence of any proof of the human variety having ever been dependent upon ingestion or inoculation of the virus of the bovine variety tends to strengthen such a belief. To this it may be replied, that the bacilli of bovine tuberculosis are identical — according to all bacteriological methods at present known — with those found in tubercular formations in the organs of man, and that, although the disease presents anatomical differences in man and cattle, these differences may be explained as being due to differences of soil in the human and bovine tissues, the bacilli ingrafting themselves in those tissues which present conditions most favorable to their growth and development; second, absence of proof may only mean want of observation or recorded data, and cannot be held to imply that at no future time will satisfactory evidence of the dependence of the human disease upon a bovine source be brought to light.

"Having regard to all those considerations, surely the time has arrived when a radical change in the present methods of milk-production and milk-consumption is urgently needed. In the first place, it should be rendered illegal for cows known to be suffering from tuberculosis to be kept in stock by dairymen and farmers for milking purposes; and, second, in no household should unboiled milk be consumed, more especially by children. No other animal food is consumed by civilized nations in an uncooked state; and by the light of our recently acquired knowledge it would appear that there is as much, or more, danger connected with the practice of drinking unboiled milk as of eating raw flesh.

"Exposure to the heat of boiling water for five minutes destroys the life and action of the tubercular virus (Klein); and the same is true of the other specific disease-poisons. By such simple means, then, is it possible to guard against an ever-present source of danger, as well as to obtain protection from those possibilities of the introduction into our bodies of the viruses of enteric-fever, scarlet-fever, and the like, which the experience of past epidemics has taught us to be latent possibilities in milk, with powers of development at the most unexpected periods. If medical practitioners generally recognized the importance of these views, and were careful to enforce them upon those intrusted with the care of delicate children of scrofulous diathesis, or with hereditary tendencies to tubercle, a commencement would be made in the right direction, which would gradually extend itself through all classes of society."

ACTION OF BOILING WATER ON TYPHOID BACILLI. — Wilchur of St. Petersburg has found that when a volume of boiling water equal to that of a gelatine culture of typhoid bacilli is used on the culture, the bacilli are only partly destroyed; and that when the volume of water is double that of the culture, all the bacilli are killed. Experiments on the dejecta of typhoid patients showed that when four times the volume of water was added to the dejecta, the bacilli were invariably destroyed.

DEATHS FROM POISON. — There were in Great Britain, in 1886, 511 deaths from poison, including cases of chronic poisoning by lead. Of these, 327 were accidental, 178 suicidal, and only 6 homicidal. Lead heads the list of agents giving rise to accidental poisoning (95 cases); then follow opium and its derivatives (82 cases); carbolic acid (20 cases); belladonna is responsible for 9 cases; alcohol for 7; aconite, chlorodyne, and hydrochloric acid, each for 6; prussic acid, ammonia, and strychnine, each for 5. Carbolic acid was selected by 42 suicides; opium, laudanum, or morphine, by 41; oxalic acid, by 28; prussic acid, by 25; vermin-killer, by 18; hydrochloric acid, by 15; strychnine, by 14; sulphuric acid and arsenic have lost their popularity, the former having been used only by six and the latter by five persons.

DEATH IN BLIZZARDS DUE TO ASPHYXIA. — Markham writes to the *Journal of the American Medical Association* of Feb. 18, 1888, stating that there is an amount of evidence and a combination of circumstances sufficient to show that the greater number of the several hundreds who lost their lives in the recent great blizzard of the North-west perished from asphyxia, and not by freezing. Many of the bodies, when found, were in the position of grasping or clutching at their necks or throats. Indoor witnesses describe the atmosphere as having an appearance of density and darkness, similar to that stated by divers as existing when submerged with their armor in deep water. Many that escaped describe their peril as being from loss of breath or suffocation.

CROTON WATER. — At a recent meeting of the Medical Society of the County of New York, Dr. John C. Peters read a paper on 'The Water-Supply from the Croton Lake System,' in which he stated that the sewage created by 25,000 people, the largest condensed-milk factory in the world, 10,000 cows, 1,200 horses, 1,500 hogs, and 40 factories, was all being run into that body of water from which the city of New York draws its water-supply. While in former years the Thames water used by London contained five times as much bacteria as Croton water, recent investigations showed that in one cubic centimetre New York water contained 526 bacteria, against 44 contained by London water. While, of course, the greater part of these were the common, harmless bacteria, still there was a large proportion capable of producing disease; and he expressed the opinion that a great deal of the scarlet-fever, diphtheria, and other infectious diseases which prevailed in New York, might be traceable to germs derived from the water-supply.

HAIR-WASHES. — We learn from the *American Analyst* that recent analyses have shown, that of the preparations for bleaching the hair to "the delicate golden shade so much admired by the court circles of Europe, and the best society of the United States," to quote from a label on one of the bottles, all depend for their action upon the decolorizing and corrosive influence of nascent oxygen or nascent chlorine. The bases used in the various nostrums for this purpose are peroxide of hydrogen, aqua regia, and bronzer's acid. Peroxide of hydrogen is the mildest and most innocuous of the trio named. It is a colorless liquid which destroys the natural color of the hair, and which, if used long enough, turns it an unnatural grayish-white. It is rather expensive, and is therefore used much less than the two other acids. It produces sores upon the scalp, and gives rise to skin-complaints that resemble tetter, salt-rheum, and scald-head. The two acids are equally vile. They attack and eat the hair and skin alike. The former they partly bleach, and partly burn to a handsome gold color; the latter they stain to about the same hue as does a light application of iodine. Besides the dermatologic troubles named, they cause maladies hardly distinguishable from eczema and erythema. One curious disease that they cause is an inflammation of the cells of the hair follicles. The cellular walls break down, and lymph, and often blood, is extravasated in appreciable quantities. All three bases produce falling-out of the hair and premature baldness.

BOOK-REVIEWS.

The Social Influence of Christianity. By DAVID J. HILL. Boston, Silver, Burdett, & Co. 12°. $1.25.

THIS volume consists of a series of lectures delivered at the Newton Theological Institution, and designed partly to show what Christianity has done for society in the past, but more particularly to indicate its attitude toward the problems of the present. The treatment of such themes in lectures is attended with serious drawbacks, as it tempts the speaker to be what is called eloquent rather than thoughtful or clear; and this tendency is plainly visible in Dr. Hill's work.

The second chapter, on what Christianity has done for society, is a perfect dithyramb; and though it may have been well liked where it was originally delivered, yet when read in a quiet hour its turgid style and exaggerated statements produce an effect quite different from what the author intended. He seems to think that the higher civilization, which is well known to be of Greek origin, is really the product of Christianity. This part of his work, indeed, is vitiated throughout by the fallacy known to logicians as *post hoc, ergo propter hoc*, a very serious fault in the treatment of social questions.

In considering the social and political problems of the present day, Dr. Hill takes the same ground that other Christian teachers do, and we cannot see that he advances any thing new. In regard to the distribution of wealth, he admits that Christianity has no means of solving the problem; and the only suggestion he has to make is that employers should treat their workmen well, and give freely in charity. It would have been far better to take the ground that the distribution of wealth is not a religious question, and that religious teachers, as such, have nothing to do with it. On the subjects of marriage and family life, and on the duties of parents to their children, the author has many good remarks; and here, as well as in the chapters on wealth, he shows himself unalterably opposed to the communistic doctrines now so widely prevalent. The chapter on 'Christianity and the Problems of Education' contains an earnest and in some respects able plea for moral and religious teaching in both public and private schools.

Dr. Hill's book seems to us the work of an earnest Christian man, deeply interested in the social problems of the time, but unfortunately lacking in the analytical and critical power which the thorough treatment of those problems requires.

NOTES AND NEWS.

THE long-neglected graphic study of the Mexican tribes has within the last twenty years received a new impulse by several native and foreign scientists who published their results through their own publishers. The governments of the single States are also becoming aware of the fact that something should be done for researches on the tribes within their borders. Thus, General Mariano Jimenez, governor of Michoacan, is providing now for the publication, at public expense, of the *Anales del Museo Michoacano* at Morelia, the capital, having previously shown his love for science by founding the new Museo Michoacano, and providing for its maintenance. The editorship of the *Anales* is in the hands of the director of the museum, Dr. Nicolas Leon, well known already through his republication of ancient books on Indians and their languages. The first three numbers (all published in 1888) which have come to hand contain thirty-two pages each, and the following treatises: 'Arithmetic among the Tarascos (Tarascan Numerals);' 'Etymology of Tarascan Geographical Names;' 'The Tarascan Grammar of Father Lagunas (in the Original Text);' 'On the National Name "Tarasco;"' 'The Tarascan Calendar (after a Manuscript in the Congressional Library, Washington);' 'Codex Plancarte, on Tarascan Antiquities of the Fifteenth and Sixteenth Centuries.' The *Anales* may be ordered through George A. Leavitt & Co., 787–789 Broadway, New York City.

— A book of a singular value for ethnography is Lieut. H. T. Allen's 'Report of an Expedition to the Copper, Tananá, and Kóykuk Rivers in Alaska, 1885,' an octavo government publication of one hundred and seventy-two pages, and many maps and illustrations from photographs. The exploring force consisted of three men, and had to proceed up the Copper River, and descend the Tanana River valley. Its explorations covered a space of approximately two hundred and forty thousand square miles and seventeen degrees of latitude, the area of which was almost entirely unknown up to the present time. The narrative of the exploring party is of picturesque and varied interest, and in every way is highly instructive for future travellers through these lonesome tracts. The observations made on the characters of the savages show that the former often partake of the burlesque. Among the tribes met with, we mention the Midnooskies, Mahlemuts, Atnatánas, Tananatánas, Ingaliks or Kaíyu-Khotánas, Unakho-tánas, Mnakho-tánas, Nabesna-tánas, etc. The tribes ending in *-tána* ('men') are all of the Tinné stock, while those in *-miut* are Innuit or Eskimo. The appendix contains zoölogical, geological, mineralogical, and meteorological observations of value.

— *Nature* attributes to the Vienna correspondent of the *Times* the announcement, that, in pursuance of a resolution passed at a recent meeting, the Vienna geologists will invite the International Geologists' Congress, which will assemble in London in September, to hold its next meeting in Vienna.

— At a recent meeting of the Victoria Royal Society, according to *Nature*, the president (Professor Kerrot) announced that the first meeting of the Australian Association for the Advancement of Science would be held at Sydney, beginning Sept. 4, the second at Melbourne, the third at Adelaide. The proposal that Victoria should join in the movement was favorably received, but at that meeting no action was taken in the matter.

— The Statistical Abstract for 1887, just issued, gives the following interesting figures in regard to the schools of the United States. In 1871–72 there were in this country 12,828,847 children of school-age, of whom 7,479,656 were enrolled in the public schools. These pupils were taught by 81,509 male, and 124,180 female teachers, to whom aggregate salaries of $37,503,309 were paid. The total expenditure for the schools that year was $70,891,374. In 1884–85 the school population had increased to 17,764,658, and the number of pupils enrolled in the public schools to 11,464,661. The number of male teachers was 109,632, and of female 199,422, to whom salaries amounting to $73,932,c68 were paid. The total expenditures upon the schools for the latter year were $111,521,542.

— A very successful meeting of the Massachusetts Assembly of the Agassiz Association was held at Boston, May 29, 30, and 31. The sessions were held in the lecture-room of the Boston Society of Natural History, by the courteous invitation of that organization; and there, after a preliminary meeting of the delegates at the Parker House, the convention assembled at 8 o'clock Tuesday evening for a business meeting. The business consisted almost entirely in the election of officers, and, with scarcely an exception, the old board were re-elected. At 9 o'clock Wednesday morning President Farrar, of the assembly, opened the exercises by an address of welcome, to which the president of the Agassiz Association responded. Reports of work were next given by delegates from the twenty-one chapters represented, and from the Boston Assembly. These reports were of the most interesting character, and showed not only the deepest earnestness on the part of the chapters, but also gave evidence of much faithful work already accomplished by them. The convention was next addressed by Prof. Edward S. Morse, director of the Peabody Academy of Science at Salem, Mass. Professor Morse stated forcibly the advantages of a thorough scientific training, and cordially commended the association for the good work it has accomplished, pointing out various lines in which it may hereafter work to increased advantage. Prof. Alpheus Hyatt, curator of the Boston Society of Natural History, followed in a most helpful address, in which, after heartily seconding Professor Morse's suggestions, he emphasized still more strongly the possibilities of usefulness that are in the association, and showed the great desirability of securing as soon as possible such an endowment as may place the work of the Agassiz Association upon a permanent basis. He then gave a clear account of the Agassiz Museum, which the delegates were soon to visit, explaining the principles which rule in the arrangement of its contents, and illustrating by diagrams and carefully selected specimens, the distribution of the collections in the different rooms. Dr. Lincoln closed the morning by an exceedingly instructive and interesting address on the minerals of Boston and vicinity. In the afternoon and evening, parties of delegates, under the guidance of committees from the Boston chapters, visited various places of interest. About one hundred were present during the convention, many pleasant acquaintances were formed, and all felt that a long step had been taken toward advancing the assembly toward that position of stability to which it aspires. Perfect harmony prevailed, and the delegates separated with the firm determination to work for the association more diligently than ever; and this determination was expressed not carelessly, but with actual enthusiasm. In addition to those mentioned above, Prof. W. O. Crosby gave a most suggestive and helpful address.

— The fifth annual convention of the Association of Official Agricultural Chemists will be held at the United States Department of Agriculture on Thursday, Friday, and Saturday, Aug. 9, 10, and 11. All who are interested in the analysis of fertilizers, cattle-foods, dairy products, alcoholic beverages, and sugar are invited to attend.

— The State Board of Health of Michigan has just published its fourteenth annual report, for the fiscal year ending September, 1886. It contains very many valuable papers, to most of which we have already referred in *Science*. Among the most important are the following: 'Tyrotoxicon, its Presence in Poisonous Ice-Cream,' by Victor C. Vaughan, M.D., Ph.D.; 'Analysis of Five Hundred Deaths occurring in the Michigan Mutual Life Insurance Company,' by Henry F. Lyster, M.D.; 'Causation of Pneumonia,' by Henry B. Baker, M.D., with illustrations, diagrams, etc.; and 'Communicable Diseases in Michigan during the Year ending Dec. 31, 1886.'

—The cod and whale fisheries in the north of Norway, according to *Nature*, have entirely failed this spring, and it is suggested that the non-appearance of the former is due to the low temperature of the sea this season. Thus the Russian naval officers stationed on the Murman coast found in May only a surface temperature of from 1° to 2° C., and along the Norwegian coast it has been lower still. As to the whale-fishing, only 40 animals had been captured by the end of April, against 200 last year. It is maintained that the present wholesale slaughter carried out by Norwegian and Russian steamers equipped with harpoon guns will eventually extirpate these animals, and some measure for their preservation is contemplated. Advices from the Arctic regions state that there was an enormous mass of drift-ice in those waters during this spring. Two sealers, the 'Hekla' and the famous 'Vega,' were imprisoned for more than a month in the ice to the north-east of Norway.

— We learn from *Nature* that the annual meeting for the election of fellows of the Royal Society was held at the society's rooms in Burlington House on June 7, when the following gentlemen were elected: Thomas Andrews, F.R.S.E.; James Thomson Bottomley, M.A.; Charles Vernon Boys; Arthur Herbert Church, M.A.; Prof. Alfred George Greenhill, M.A.; Lieut.-Gen. Sir William F. D. Jervois, R.E.; Prof. Charles Lapworth, LL.D.; Prof. T. Jeffery Parker; Prof. John Henry Poynting, M.A.; Prof. William Ramsay, Ph.D.; Thomas Pridgin Teale, F.R.C.S.; William Topley, F.G.S.; Henry Trimen, M.B.; Prof. Henry Marshall Ward, M.A.; William Henry White, M.I.C.E.

— The laying of the corner-stone of the new building of the Pennsylvania Agricultural Experiment Station took place Wednesday, June 27, at State College, Penn.

— The New York Mineralogical Club has arranged for excursions on the Saturday afternoons of the present season. It is intended that these outings shall acquaint the members personally with the most interesting localities of the neighborhood; enable them to secure specimens suitable for the permanent cabinet of the club, as well as for private possession; and enlarge the influence of the club by associating with its regular members, in these informal trips, any persons of suitable standing (ladies or gentlemen) who may feel an interest therein.

— The thirty-seventh meeting of the American Association for the Advancement of Science will be held at Cleveland, Aug. 15–21. The date of Aug. 22 was determined upon; but owing to the national gathering of the Knights Templars in Cleveland during that week, and at the earnest solicitations of the local committee, the council have changed the date to Aug. 15. A large local committee has been organized, the several sub-committees of which are working earnestly, and, so far as depends upon the committee, a successful meeting is assured. A special office and reception-rooms for the association have been opened at No. 407 Superior Street, next door to the Hollenden, where will be the hotel headquarters. The meetings will be held in the Central High School building on Wilson Avenue, where also will be the offices of the local committee and of the permanent secretary during the week of the meeting. A special circular in relation to railroads, hotels, and other matters, will be issued by the local committee. The members of Section E will hold an informal meeting at the Central High School building on Tuesday, Aug. 14, at 3 o'clock, to consider plans for holding sessions between the annual meetings of the association. The Entomological Club will meet at 9 A.M., on Wednesday, Aug. 15, at the Central High School building. The Botanical Club will hold a meeting, as usual, on the day preceding the meeting of the association, in the Central High School building. The Society for the Promotion of Agricultural Science will hold its ninth annual meeting in Cleveland, beginning on Monday evening, Aug. 13, at the Central High School building, and continuing on Tuesday.

— During the summer of 1887, the manager of the physical and chemical department of James W. Queen & Co., Mr. Joseph J. Walton, made a three-months' tour in Europe for the purpose of perfecting arrangements for the sale of new forms of apparatus in this country, and also to look up any thing new and interesting which would be of value to those interested in these and other branches of science. One of the first places visited was the laboratory of Sir William Thomson, at the University in Glasgow. Mr. Walton also had the pleasure of examining the newly equipped laboratory of Professor Ayrton at the City and London Guilds Institute, and the Cambridge Scientific Instrument Company stock of physiological apparatus. Another valuable result of the stay in England was the arrangement which has been made for the furnishing of practical and cheap apparatus for the use of students in the study of physics by the new method, — that of allowing the student to experiment for himself. A visit was paid to the works of Siemens Brothers & Co. In Paris special attention was paid to the physiological apparatus of Verdin. Special attention was paid, both in Paris and Berlin, to the subject of apparatus for the study of bacteriology. At the well-known house of Duboscq, in Paris, a number of new optical instruments were examined and purchased. Quite a visit was paid to the ateliers of the Société Genevoise pour la Construction d'Instruments de Physique at Geneva. The optical establishments in Munich were among the places visited. Steinheil, Merz, and others have long been known as the best makers of prisms, lenses, etc., in Europe. Some new forms of balances were found by Mr. Walton. One has a very ingenious new arrangement for varying the sensibility. We may add there are other instruments of which we have not spoken, for which the firm soon hope to have price-lists ready and to put on the market. Some of these may prove of even greater value than many of those mentioned.

— *Engineering* gives an account of a new material bearing the name of 'woodite,' which is being introduced as a protection to ships of war, and for many other purposes. Woodite is a substance bearing a strong resemblance to native india-rubber, but, unlike that material, it never grows sticky, and resists the action of oils and heat. If it be placed on the outside of a vessel, a shot may be driven through it, and yet it will close up so completely that it is difficult to find the speck which marks the spot where the shot entered. Woodite is coming into use for many commercial purposes, such as delivery-valves, air-pump valves, packing, wheel-tires, and it is said to be far more efficient for these purposes than either leather or india-rubber.

— The French General Translantic Company has furnished its large fleet with complete apparatus for dropping oil on the waves during bad weather. The company states that it has adopted the use of oil after repeated trials.

— Ginn & Co. will publish in July 'A College Algebra' prepared by Professor Wentworth. —— William S. Gottsberger publishes a volume of five tales of ancient Greece entitled 'Pictures from Hellas,' by Peder Mariager, translated from the Danish by Mary J. Safford. —— D. C. Heath & Co. will publish at once Volume II. of Dr. Bernhardt's 'Novelletten Bibliothek.' —— The Worthington Company will publish at once a book entitled 'William Shakspeare portrayed by Himself: a Revelation of the Poet in the Career and Character of One of his Dramatic Heroes,' by Robert Waters. —— Waterman & Amee, Cambridge, Mass., have in press a volume of 'Selections illustrating Economic History since the Seven-Years' War,' by Benjamin Rand. —— Prof. Richard T. Ely's treatise on 'Taxation in American States and Cities,' recently published by T. Y. Crowell & Co., is to be used as a text-book in the Buffalo Law School and at Vanderbilt University.—— The Historical Publishing Company, 61 Broadway, New York, will publish at once a volume entitled 'Camp-Fire Stories,' by W. F. Cody ('Buffalo Bill'). It is not altogether about his own frontier experiences that Mr. Cody has written, but of those of Daniel Boone, Kit Carson, and other pathfinders. The manuscript, which makes seven hundred printed pages, was dictated to a stenographer during 'Buffalo Bill's' English trip. —— 'Methods and Aids in teaching Geography,' is the title of a new educational work by Charles F. King, A.M., head master of the Dearborn School in

Boston, to be published by Messrs. Lee & Shepard. The same firm has now in press a new volume of travels entitled 'Mexico, Picturesque, Political, Progressive,' the joint work of Mrs. Mary Elizabeth Blake of Boston, and Mrs. Margaret F. Sullivan of Chicago. —— Dr. Allan McLane Hamilton will contribute a paper in the July issue of *The American Magazine* on 'Spiritualism and Like Delusions,' in which he will show that spiritualism is at best a form of mild insanity. —— The *Popular Science Monthly* for July contains the following articles: 'Safety in House-Drainage,' by William E. Hoyt; 'Gourds and Bottles,' by Grant Allen; 'Darwinism and the Christian Faith;' 'The Teaching of Psychology,' by M. Paul Janet; 'Customs and Arts of the Kwakiool,' by George M. Dawson; 'Lines of Progress in Agriculture,' by Dr. Manly Miles; 'Fallacies in the Trades-Unions Argument,' by J. B. Mann; 'Botany as it may be Taught,' by Prof. Byron D. Halsted; 'Arctic Alaska,' by W. L. Howard; 'Manual or Industrial Training,' by Prof. G. Von Taube; and a sketch of Paul Bert. —— *Time*, under which title *Tid-Bits* will hereafter be known, as being more nearly answerable to the present character of the paper, will be conducted on the same lines which have won *Tid-Bits* its success; the changes made with the present issue being external only, and not affecting the methods of the paper, which remains under the same proprietorship and editorial management.

— The *Engineering and Mining Journal* is authority for the statement that the 'record' in rapid machine-work has again been lowered. Heretofore the Baldwin Locomotive Works of Philadelphia have held the first place with the record of an engine built in twenty-four hours, but the Pennsylvania Railroad Company has now taken the palm by constructing a full-sized (110,000 pounds) anthracite-burning locomotive at the Altoona shops in sixteen hours fifty-five minutes. The work was commenced on the morning of the 18th of June, and in five minutes less than seventeen hours the engine was turned out ready for use. It is to run on the New York division of the Pennsylvania Railroad. This feat is, we believe, quite unrivalled in locomotive-building.

— Prof. Simon Newcomb, superintendent of the Nautical Almanac Office, is seriously ill of spinal irritability, and, on the recommendation of a board of medical officers, has gone to the Chelsea Hospital for special treatment.

— Dr. W. J. Hoffman of the Bureau of Ethnology has gone to northern Minnesota to obtain some important historical information which has been promised him by influential Indian chiefs who live near the Canada line.

— Mr. Arthur P. Davis of the Geological Survey Office, and Miss Lizzie Brown of the Nautical Almanac Office, were married on the evening of the 21st inst. Mr. Davis is a nephew of Major J. W. Powell, director of the Geological Survey, and Miss Brown is one of the most accomplished mathematicians in the country. Each had been a member of the Corcoran Scientific School of the Columbian University, and each had just received its degree of Bachelor of Science.

— The Signal Office has been making experiments in the court-yard of the War Department building with a new machine for testing anemometers. The device consists of several arms, each twenty-eight feet long, on the ends of which are placed anemometer-cups such as are used in the Signal Service. The arms being revolved at a given rate of speed, the rate recorded by the anemometer-cups is compared with the known rate, and any differences noted. Professor Hazen, who has had charge of the experiments, says that they have been satisfactory, although absolutely still air has not been obtained in the War Department court-yard. Even when there was a dead calm outside, a very perceptible movement of the air inside the court-yard was observed. This phenomenon, which occurred early in the morning, was attributed to the fact that the court-yard had become greatly heated the day before, and the warm air was then rising and being forced out by the cooler, denser atmosphere from the outside, that came into the court-yard through the two carriage-ways. Similar experiments to discover the exact relation between the movement of the wind and the whirling of the cups were made about 1850, but in the machine used then the arm was only four feet long, instead of twenty-eight as in the new one. When the short arms were whirled with great velocity, they caused a very perceptible movement of the air.

— The magnificent water-front of Staten Island is so important a part of New York harbor, and access to it from the mainland is so easy, that more or less definite projects for reaching it by railroad have been often brought forward. The Arthur Kill Bridge, which is now practically completed, will, if it is allowed to stand, enable the lines now entering Jersey City to reach directly the deep water on the Staten Island front, and will greatly increase the available capacity of the harbor for handling freight.

— In *Bradstreet's* of June 23 is given the message of Dr. Miguel Juarez Colman to the National Congress of the Argentine Republic. In this message are presented important facts in regard to the progress of this South American Republic. Argentine Republic has an area of 1,125,086 square miles, with a population in 1887 of 3,935,286. It has made wonderful progress in the building of railways. Of the 17 railways conceded, 13 have the guaranty of the government. The guaranteed lines report a length of 7,961 kilometres, and the unguaranteed 1,272, making 9,233 kilometres. The contracts for the following guaranteed lines are already prepared: Tartagal Reconquista to Formosa, Bahia Blanca to Ville Mercedes, San Juan to Salta, Chumbreha to Tinogosta and Andalugata, Goya to Monte Caseros, Resistencia to Metan, and San Custobal to Tucaman. The aggregate length of railways in operation is 6,306 kilometres, equal to $3,918\frac{4}{10}$ miles. These roads have carried within a year 7,657,406 passengers and 3,705,876 tons of freight. The gross revenue from the yearly traffic is $23,805,722.15, against expenses of $13,177,172.15, giving a net annual revenue of $10,627,950.14. The debt of the Republic March 31, 1888, was: internal, $47,100,000; and external, $92,427,000. The latter is expected to be paid off within eight years. Argentine 5-per-cents issued in 1887 at $85\frac{1}{2}$ were on March 31 quoted at 97, and the 6-per-cents at 102 @ $104\frac{1}{2}$. In 1886 the import and export trade aggregated $194,000,000. In 1887 it had increased $24,000,000, of which $9,500,000 were imports, and $14,500,000 exports. The gain is due to the increased production of cereals, hides, and frozen meats. The suppression of export duties has also contributed to the increase in the volume of exports. Import and export values in the first quarter of 1888 show an increase, when compared with the first quarter in 1887, of $4,000,000. In 1884 the total revenue was $46,762,000. The revenue for 1887 was early estimated at $50,522,000, but it produced $58,135,000, or $13,372,000 in excess of the revenue of 1886. The budget of expenses in 1887 was $43,263,000, and $6,756,000 for special laws without special resources, leaving a remainder of $8,116,000. In the fourteen provinces of the Republic are 2,080 schools, with 142,471 pupils. There are 116 schools in the capital of the Republic, including 24 graduated, 56 elementary, 20 for infants, and 16 for adults. In the 116 schools are 746 teachers, including 224 male and 522 female. In the national territories there are at the present time 42 schools, with 64 teachers and 2,998 scholars. The total immigration in 1887 was 137,000, and for the first quarter of 1888, 40,500. The expected immigration in all of 1888 is about 200,000. The cost of passage from Europe for 50,000 agriculturists and artisans will be advanced to enable them to come to Argentine Republic in 1888. The commissary of immigration has gone to Europe to establish the requisite appliances to promote immigration. Immigration, colonization, and railways are rapidly transforming the country, and as a consequence its productive forces are being multiplied, and the comforts of life there are increased. The field of labor is enlarged, the educational work is taking rapid strides, and internal improvements are receiving attention from the government.

— The courses in physics which were proposed for this summer at Harvard College have been given up because of the small number of applications for them received up to June 1, which was the date mentioned in the physics circular. On Saturday, July 7, and on Saturday, July 14, an exposition of the apparatus and methods which would have been used in the elementary summer course will be given at the Jefferson Physical Laboratory, Cambridge, the hours each day being from 10 to 1 and from 3 to 5. This exposition will be for the benefit particularly of those who propose to teach the elementary physics of the requirements for admission to Harvard College. Admission will be free.

— We learn from *Nature* that the conferences convened by the London Chamber of Commerce to consider the question of commercial education led to the appointment of a committee for the full discussion of the subject. This committee nominated a sub-committee, among the members of which were Sir John Lubbock, Sir Henry Roscoe, and Sir B. Samuelson. A scheme for the improvement of commercial education has now been drawn up by the sub-committee, and sent to various business-men, schoolmasters, and other authorities on education, with a request for practical suggestions. The scheme, as it stands, proposes as obligatory subjects for examination for a commercial certificate, (1) English; (2) Latin; (3*a*) French; (3*b*) German, Spanish, or Italian; (4) history of British Isles and colonies, general and modern history, including commercial history; (5) geography, physical, political, commercial, and industrial; (6) mathematics; (7) drawing. Proficiency is also required in at least one of the following: physics, chemistry, natural history, commerce, and political economy.

LETTERS TO THE EDITOR.

**** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

Twenty copies of the number containing his communication will be furnished free to any correspondent on request.

The editor will be glad to publish any queries consonant with the character of the journal.

The Ancient Works of Ohio.

As investigation and explorations proceed, one ray of light after another pierces the mystery which has so long hovered about the ancient works of Ohio, enabling us thereby to catch glimpses of the prehistoric times of that great State. As was stated in a former communication, the evidence obtained through the explorations of the Bureau of Ethnology bearing upon the origin of the typical works of that State leave but little if any doubt that they were built by the ancestors of the Cherokees; but this must be understood as applying only to the circles and squares, and other works of this type, together with the mounds pertaining thereto, or bearing indications of having been built by the authors of the enclosures. The links of this chain have been gathered from the Ohio antiquities, the mounds and works of West Virginia, East Tennessee, and western North Carolina; in fact, the chain is not single, but multiple, for there are several distinct lines of evidence leading to the same conclusion. Some items bearing on this question have been published in *Science* and elsewhere, but since those appeared additional testimony has been obtained by the bureau.

But Ohio was the home of more than one mound-building tribe: there are good reasons for believing that we find here the work of six or seven different peoples or tribes: —

First, The typical works by the Cherokees, before mentioned.

Second, The walls, enclosures, and other defensive works of Cuyahoga County and other northern sections of the State. The key which will help to solve the riddle of the monuments of this type is to be found in central and western New York, the former home of the Iroquois nations: in other words, they are attributable to some branch of the Iroquois or Huron-Iroquois stock. It is possible, and even probable, that the works of Cuyahoga County are attributable to the Eries; but this, if admitted, is only another proof that this tribe pertained to the Iroquois group. The same type of works is also found in eastern Michigan as far north as Ogeman County.

Third and *Fourth*, The box-shaped stone graves. There is no longer any good reason for doubting that the burial-cists of this type, found in Ohio, are attributable to two tribes, — the Delawares and Shawnees; those of the central portion of the State, especially of Ashland County, marking the burial-places of Delaware Indians, and those found along the Ohio River the burial-places of Shawnees. There are, however, no marks or peculiarities by which the works of the two tribes in this State can be distinguished from each other. As but few graves of this type are found in mounds in Ohio, it is more than probable that they belong to the time of the later occupancy of this region by these tribes. Nevertheless there are some reasons for believing that some of the works in Hamilton County pertain to an earlier occupancy of that section by the Shawnees; but this point cannot be satisfactorily settled until further explorations have been made in adjoining portions of Kentucky.

Fifth, Certain stone mounds, and mounds containing stone vaults or graves of a peculiar type, which it would be difficult to explain without the use of figures, which cannot be introduced here. Sepulchres of this type have been found at various points in the northern half of Kentucky, from the extreme north-east corner of the State as far west as Union County; but in Ohio they have as yet been discovered only in a few of the extreme southern counties. This type of works is peculiar, and presents a problem to which we have thus far been unable to find any clew. It is probable that the builders belonged to a tribe which has become extinct. Unless certain works in north-east Missouri, which bear some resemblance to those of the type mentioned, are attributable to the same people, no traces of them are to be found elsewhere than in the sections mentioned. Is it possible that the appellation 'Bloody Ground' is an echo which has floated down the ages from prehistoric times? These sepulchres indicate a savage life and fierce warfare with beasts of prey.

Sixth, The effigy mounds, of which some two or three only are known within the limits of Ohio. These also present a problem difficult to solve. It is possible that some sudden freak of the medicine-men or medas of some one of the tribes mentioned may have brought about the building of these strange works, but such a supposition is far-fetched and without any basis. It is more likely that a straggling clan or small tribe of the Wisconsin mound-builders, — probably belonging to the Dakotan stock, — wandering toward the south-east, left these mementos of their passage. The bird-effigies of Georgia may possibly have been built by the same people. Such breaking-away of a clan or tribe and its wandering to a distant locality is not without parallel in Indian history.

Seventh, Fortifications of that type of which Fort Ancient is an example. Although I have introduced this type under a separate number, I am inclined to attribute the principal works of the class to the builders of the typical works of the State, — the Cherokees. This is also the opinion of most of our archæologists, yet the relation between the works in some cases is not apparent. Fort Ancient is an example of this kind. Moreover, there are some indications in this instance of the influence of the white man, especially in the northern section of the work.

Omitting the last from the list, there remains clear and satisfactory evidence that the ancient works of the State are due to at least six different tribes. CYRUS THOMAS.

Youngsville, Penn., June 25.

Distillation of Mercury at Ordinary Temperatures.

In the physical laboratory of the United States Geological Survey a normal barometer hangs in a window-jamb about 35 centimetres from the glass of the window. As the window faces east, it has the sun until noon. The barometer-tube at and above the upper surface is 25 millimetres in diameter, and extends 6 centimetres above the mean position of that meniscus. It was observed that during the summer small globules of mercury covered the inner wall of the tube above the column, on the side farthest from the window. In the winter they collected upon the side nearest to the window. An inspection showed that the radiation from the tube was greatest toward the cool room in the summer, and toward the window and out of doors in the winter, thus keeping the side of greatest radiation slightly cooler than the mass of the reservoir, and condensing upon it some of the vapor of mercury of the Toricelli vacuum. In this way several grams were condensed and fell back in a single month, — a fact which seemed quite interesting when it is remembered that the vapor-tension of mercury at even 30° C. (86° F.) is only .06 of a millimetre. Of course, by bending the top of the tube over and downward toward the cooler side, the distillate could be collected and measured. W. HALLOCK.

Washington, D.C., June 21.

Calendar of Societies.

Biological Society, Washington.

June 2. — F. H. Knowlton, Notes on the Fossil Wood of the Yellowstone National Park; W. B. Alwood, Notes on the Artificial Pollenation of Wheat; F. A. Lucas, Abnormalities in the Ribs of Birds.

Engineers' Club, Philadelphia.

June 2. — A. Marichal, Public Health of Cities and Towns; W. S. Sheafer, Notes on the Coal-Deposits of Sonora, Mex.; A. W. Sheafer, Electric Haulage in Anthracite Mines; G. W. Jones, Valve Motion; Howard Constable, The Montague Street Electric Railway and Elevated Terminal Station at Wall Street Ferry, New York; L. M. Haupt, The Great Transportation Areas of the United States.

Mineralogical Club, New York.

June 8. — Oxides and Carbonates of Copper.

Torrey Botanical Club, New York.

June 12. — N. L. Britton, Description of a Collection of Plants from the Mountains of Arizona, sent by Dr. E. A. Mearns, U.S.A.

American Institute of Electrical Engineers New York.

June 13. — Frank J. Sprague, The Solution of the Municipal Rapid-Transit Problem.

Society of Medical Jurisprudence and State Medicine, New York.

June 14. — J. B. Matteson, M.D., Ethics of Opium Habitués; W. A. Purrington, The Desirable and the Practicable in Legislation regulating the Practice of Physic and Surgery.

American Academy of Arts and Sciences, Boston.

June 13. — William G. Farlow, Biographical Notice of Dr. Asa Gray.

Appalachian Mountain Club, Boston.

June 13. — F. H. Chapin, Long's Peak, Colorado; Miss L. A. Putnam, The Crater of Mount Misery, St. Kitts.

Engineers' Club, St. Louis.

May 30. — R. E. McMath, The Water-Way between Lake Michigan and the Mississippi River, by Way of the Illinois River.

Publications received at Editor's Office, May 28–June 9.

CARR, L. Missouri. A Bone of Contention. (American Commonwealths.) Boston, Houghton, Mifflin, & Co. 377 p. 16°.
DAVIS, J. R. A. A Text-Book of Biology. Philadelphia, Blakiston. 462 p. 12°. $4.
GALLOWAY, R. The Fundamental Principles of Chemistry. London and New York, Longmans, Green, & Co. 364 p. 12°. $1.75.
GOW, J. A Companion to School Classics. London and New York, Macmillan. 378 p. 16°. $1.75.
GOYEN, P. A Higher Arithmetic and Elementary Mensuration. London and New York, Macmillan. 360 p. 16°. $1.30.
HAYES, H. Sons and Daughters. Boston, Ticknor. 473 p. 16°.
JENNINGS, A. C. Chronological Tables. A Synchronistic Arrangement of the Events of Ancient History. London and New York, Macmillan. 123 p. 12°. $1.25.
JONES, C. C., Jr. Negro Myths from the Georgia Coast. Boston and New York, Houghton, Mifflin, & Co. 171 p. 12°.
LOCK, J. B. Trigonometry for Beginners as far as the Solution of Triangles. London and New York, Macmillan. 135 p. 16°. 60 cents.
MICHIGAN State Board of Health, Fourteenth Annual Report of the Secretary of the, for the Year ending Sept. 30 1886. Lansing, State. 341 p. 8°.
MILLER, O. T. In Nesting Time. Boston and New York, Houghton, Mifflin, & Co. 275 p. 16°.
OHIO, Report of the Geological Survey of. Vol. VI. Economic Geology. Columbus, State. 831 p. 8°.
PHILOSOPHICAL Society of Washington, Bulletin of the, 1887. Vol. X. Washington, Smithson Inst. 302 p. 8°.
PROCTOR, R. A. Old and New Astronomy. Part II. London and New York, Longmans, Green, & Co. 65 p. 8°.
SMITHSONIAN INSTITUTION. Annual Report of the, to July, 1885. Part II. Washington, Government. 8°.
STEELE, J. D. Popular Physics. New York and Chicago, Barnes. 380 p. 12°.
U. S. GEOLOGICAL SURVEY. Topographical Maps of Portions of Arizona, Missouri, Kansas, and Montana. 9 maps, 42 by 50.5 cm. Washington, Government, 1888.
WALTER, R. Recent Important Discoveries in Vital Science. Reading, Penn., B. F. Owen, Pr. 64 p. 16°. 10 cents.
WHISTLER, J. A. M. "Ten O'clock." Boston, Houghton, Mifflin, & Co. 29 p. 12°.
WOOLF, S. An Elementary Course in Descriptive Geometry. New York, Wiley. 152 p. 8°. $3.

Positions Vacant.

Inquiries from employers in want of those skilled in any department of science in its widest sense will be inserted in this column WITHOUT CHARGE.

The labor and expense involved in ascertaining what positions are open, in gratuitously advertising them and in attending to the correspondence of applicants, are incurred in the interest and for the *exclusive* benefit of *subscribers* to *Science*.

Applicants should inclose the necessary postage, for forwarding their letters.

Map of the Yellowstone Park.

1,375,000.

SCIENCE, June 1, 1888. No. 278.

Fan Creek
Sepulchre Mt.
Hotel
Mammoth Hot Sps.
Mt. Evarts
Joseph P.
Little Quadrant
Gray P.
Fawn Cr.
The Pocket
Gardiner R.
Rustic Falls
Terrace Mt.
Undine Falls
Wraith
Osprey Falls
Bunsen P.
Geode Cr.
Crescent Hill
Garnet Hill
Hell Roaring Cr.
Elk Creek
Yancey's
Lost Cr.
Baronette Bridge
Bison P.
Slough Creek
Buffalo Cr.
Baronette P.
Abiathar P.
West Gallatin R.
Quadrant Mountain
Bannock P.
Bighorn Pass
Panther Cr.
Antler P.
Crowfoot Ridge
Gallatin Lake
Grayling Cr.
Three River P.
Indian Cr.
Echo P.
The Dome
The Crags
Trilobite Pt.
Mt. Holmes
Christmas Tree Park
Winter Cr.
Straight Cr.
Beaver Lake
Obsidian Creek
Lava Creek
Lupine Creek
Blacktail Deer Creek
Prospect P.
HorseShoe Hill
Obsidian Cliff
The Landmark
Lake of the Woods
White Rock Springs
Storm P.
Tower Creek
Clearwater Spr.
Roaring Mt.
Amphitheatre Spr.
Twin Lakes
Roadside Spr.
Observation P.
Gneiss Cr.
Maple Cr.
Norris Geyser Basin
Grebe Lake
Gibbon R.
Cougar Cr.
Gibbon Meadows
Sylvan Spr.
Gibbon Hill
Artists Paint Pots
Geyser Springs
Virginia Cascade
Hot Springs
Crystal Falls
Otter Creek
Monument Geysers
Beryl Spr.
Secret Valley
Cañon Cr.
Gibbon Falls 80'
Terrace Spr.
Madison River
Violet Springs
Alum Cr.
Trout Cr.
Chrome Spr.
Highland Hot Springs
Hot Springs
Magpie Creek
Nymph Spr.
Calcite Springs
Tower Falls
Undercliff Sp.
Quartz Cr.
Agate Cr.
Jasper Cr.
Specimen Ridge
Amethyst Cr.
Fossil Forest
Druid P.
Trout Lake
Soda Butte Cr.
The Thunderer
Mt. Norris
The Needles
Cache Cr.
Deep Creek
Amethyst Mt.
Opal Cr.
Mt. Washburne
Pt. Lookout
Dunraven P.
Sulphur Cr.
Washburne Hot Sprs.
Grand Cañon
Yellowstone River
Whistler Geyser
Joseph's Coat Spr.
Hot Sprs.
Broad Cr.
Moss Cr.
Hot Spr.
Mirror Plateau
Flint Cr.
Miller Cr.
Clover Cr.
Lower Falls 308'
Upper Falls 109'
Cascade Cr.
Surface Cr.
Bog Cr.
Sour Creek
Fern Lake
Pelican Cone
Crater Hills
Bluff Cr.
White Lake
The Mudkettles
Mushpots
Sulphur Hills
Thistle Cr.
Mud Geyser
Pelican Spr.
Willow Creek
Mist Creek
Cold Creek

SOMETHING

Map of the Yellowstone Park.

1,375,000.

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