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SCIENCE

NEW YORK, JANUARY 1, 1892.

A NEW PHASE OF UNIVERSITY EXTENSION.

JUST at the present critical stage of the American movement for extension teaching the practical pedagogy of this imported phase of educational activity is up for sharp and earnest discussion. It is agreed that however properly the system may have been been reared in England, American methods must be applied to its life if it is to become a recognized force in American education. The naturalization of University Extension must therefore pre-eminently mean its further organization toward useful ends.

The recent article of Professor Willis Boughton on 'Graded Work in Philadelphia," strikes the key-note for an earnest and scientific discussion, which we hope may be continued until the American society shall have nurtured extension teaching into one of the most vital forms of educational activity. Professor Boughton has outlined the plan for graded work to be pursued at certain centres, and has, moreover, called attention to the division of the Philadelphia work into "departments," although a thorough organization of these "departments" has not as yet been distinctly mooted. It is also here pertinent to note that the president of the American society, Dr. Edmund J. James, has in Philadelphia introduced the excellent plan of faculty meetings of the lecturers, with the view of eliciting the practical pedagogics of the subject.

As an attempt to continue a discussion looking toward efficient organization of university extension, the writer presents for candid criticism the following somewhat comprehensive suggestions. Stated with almost dogmatic brevity, the scheme is submitted, none the less, in the scientific spirit, and expects no other mark of favor than that derived from its accordance with the experienced facts.

The scheme proposes to establish in each great university centre extension faculties and sub-faculties of the various departments of knowledge for the development of real class-work and individual study, alongside the present lecture system. Each faculty shall in itself form a complete organization, with officers of good executive talent and broad sympathies. The presidents of the faculties, together with the president of the centre, shall form a body advisory to the executive committee of the centre.

It shall be the duty of each president, in concert with his faculty, to develop the best methods of exciting popular interest in the special subjects, and especially to determine upon the pedagogic methods best adapted to the particular subjects and to the various grades of students seeking the extension classes.

Each faculty shall, as far as practicable, arrange for class instruction continuing during eight or nine months of the year, or at any rate for courses of sufficient length to meet some tangible purpose.

Each faculty, and finally each professor, shall aim to carry along the individual in his work, rather than aim to present finely-wrought lectures — the latter being used as accessory only to the main purpose.

Inasmuch as such proposed instruction would of necessity be more expensive and demand a closer relation between the professor and the student than the present methods of extension organization seem to encourage, it would seem desirable that these special extension classes be sharply distinguished from the general extension classes. The latter are and should be open to all members, but the former only to such members as meet the terms for the special tuition, and are willing to engage in regular student work.

It would also seem proper that the tuition for each special class course should, to some extent, depend upon the number of students applying, as well as upon the nature of the subject developed.

The eventual outcome of such scheme of instruction would doubtless be the award of highly-prized certificates of the work done, or what comes to the same, the conferring of degrees, either through the universities or through the extension society itself.

As an application of this scheme of organization to a particular department, let us suppose the mathematical professors, say of the Philadelphia extension course, to be organized as a unit faculty. The courses they should propose would range from algebra, through a goodly variety of applied mathematics, to general, or even practical astronomy. Each course would be carried on in some relation to the other courses. The most cordial co-operation would exist between the several classes and professors, and both students and professors work in one or the other class, as the furtherance of the most efficient work and teaching might demand.

As an example of the method suggested, when carried down to an actual class course, the writer may be permitted to instance a course in the theory and practice of surveying, intended as one element of a school of mathematics recently proposed by him to the Philadelphia Society for University Extension. The course is based on a demand for such instruction coming to him from two classes of students, viz., (1) practical surveyors ill equipped in the mathematics of the subject, and (2) young men, who, although busily engaged during the day in other employments, desire, if possible, to equip themselves for the life of a surveyor or civil engineer. The instruction is to be given in class, by correspondence, and in the field. The class instruction, given one evening each week for eight months, embraces text-book work pursued under direction, and as rapidly as each student is able lectures on instruments, their construction, adjustment, and use, and on methods of field and office work. Correspondence is encouraged for the purpose of eliciting a better knowledge of each man's difficulties. Replies are to be given through the medium of a specially-trained stenographer or in class. Field instruction is necessarily limited to occasional work of Saturday afternoons. Practically every student is also his own class, pursuing his own work, and receiving help according to his individual needs. The method of learning by doing — ever a good one provided it is doing by method — meets also, as thus guided, the requirements of the ungraded mass of students seeking the special knowledge.

The writer would violate the very spirit of his suggestion were he to attempt to show in detail how it might apply to well-organized evening schools of chemistry, or biology, or history. But he ventures to suggest the pedagogic purposes must in these subjects differ *inter se* and from those of mathematics, and that here the chemical laboratory, the museum of natural history, and the seminar method might find interesting and useful extension.

A fair appreciation of the occasion for the above suggestions requires a concise statement of some of the assumptions made in reference to the aims and ends of university extension. It has been assumed that the final aim is to bring as much of each subject attempted, to each individual student, as the nature of the subject, the time, and the capacity of the individual student may warrant.

It has been assumed that the extension society, as the popular representative of the university, is jealously alive to the danger of indirectly promulgating false conceptions concerning the higher education, of placing mental intoxication on the same plane with mental work, or of discrediting university training, either by unsuitable methods of popular instruction, or by appearing to give all of the university training in twelve easy evening lessons.

It has been assumed that there is a popular demand, active or latent, for highly specialized information fully up to date, and such as it is alone the province of the specialist of the university to collect and promulgate.

Finally it has been assumed that as nothing save advantage can come to those seeking the special knowledge, whether for use or culture, so nothing save advantage can accrue to the university extension system or to the university itself from the adoption of a scheme of evening instruction fairly suited to the needs of the individual student. M. B. SNYDER.

NOTES AND NEWS.

IT will interest cremationists to hear that the Japanese, who some time ago adopted burial of the dead, in imitation of European nations, have reverted, according to the *Indian Medical Gazette*, to their own custom of burning the dead on account of its sanitary recommendations.

— The death of Dr. F. C. Dietrich, keeper of the Botanical Museum at Berlin, is announced. He was eighty-six years of age.

— A despatch to the New York *Tribune*, from Franklin, Ind., Dec. 26. states that Professor Gorby, State Geologist, has given his collection to Franklin College. The collection consists of 40,000 to 60 000 specimens, gathered from almost every State in the Union, and from many foreign countries.

— At the Dec. 10 meeting of the Royal Society, according to *Nature*, the president read from the chair a letter from Professor Dewar, which had been put into his hand as he entered the meeting-room, in which Professor Dewar stated that he had at 3 P.M. that afternoon "placed a quantity of liquid oxygen in the state of rapid ebullition in air (and therefore at a temperature of — 181° C.) between the poles of the historic Faraday magnet in a cup-shaped piece of rock salt (which is not moistened by liquid oxygen and therefore keeps it in the spheroidal state)," and to his surprise, Professor Dewar saw the liquid oxygen, as soon as the magnet was stimulated, "suddenly leap up to the poles and remain there permanently attracted until it evaporated."

— The educated classes of Italy are delighted with the proposed changes at the ancient University of Bologna. The commission appointed by the Government to consider the advisability of making reforms in the old institution has recommended the adoption of the plans of Signor Buriani, the well-known engineer. The cost of the new buildings, which will be an ornament to the city, is estimated at 5,000,000 lire. The philosophical and legal faculties will be housed in future in the old "Archiginnasio," while the School of Mines will occupy the present university building on the Via Zamboni. The library united with the royal and city libraries will be placed in a new palace. Great improvements will be made also in the School of Medicine, which in recent years has suffered somewhat in reputation. The University of Bologna has as grand traditions as any university in the world, and college men in all countries feel an interest in its welfare. It is, in many ways, the mother of universities, and had centuries ago 12,000 students.

— Dr. Langer, says *The Medical Record*, has been investigating the subject of suicide among the soldiers in European armies, his statistics including the years from 1875 to 1887. The largest number of suicides occurred in the Austrian army, averaging 122 a year in each 10,000 soldiers. Next to Austria is Germany, which averaged 63 suicides to every 10,000 soldiers. In the Italian army on the average 40 soldiers in every 10,000 committed suicide every year. The French army from 1872 to 1889 lost in Europe 29 soldiers to every 10,000 annually, and in Algeria it lost just twice as many by suicide. In Belgium there occurred 24, in England 23, in Russia 20, and in Spain 14 to every 10,000. The cause of suicide in the army appears in most cases to be the fear of punishment, though not a few are driven to the act through aversion to military service and despair of ever being able to return to civil life.

— In a paper, read before the Sanitary Convention at Vicksburg, the proceedings of which are published, Dr. Baker of the Michigan State Board of Health gave official statistics and evidence which he summarized as follows: "The record of the great saving of human life and health in Michigan in recent years is one to which, it seems to me, the State and local boards of health in Michigan can justly 'point with pride.' It is a record of the saving of over one hundred lives per year from small-pox, four hundred lives per year saved from death by scarlet fever, and nearly six hundred lives per year saved from death by diphtheria — an aggregate of eleven hundred lives per year, or three lives per day saved from these three diseases. This is a record which we ask to have examined, and which we are willing to have compared with that of the man who 'made two blades of grass grow where only one grew before.'"

— A recent press dispatch states that Superintendent Johnson of the Deaf and Dumb Institute at Indianapolis has been making experiments with the phonograph, and believes that in connection with it he can teach the majority of the deaf-mutes under his charge to talk. He finds that the instrument concentrates the sound at the drum of the ear in such a way that many of the pupils otherwise deaf are enabled to hear. He intends to carry the experiments further, and thinks the phonograph may become a means of teaching the use of their voices to some mutes whose inability to speak is due to the fact that they have never heard speech. He tried the phonograph with 27 boys and 29 girls. Of these, only 3 girls were unable to hear something. Twenty boys and girls could hear instrumental music, while 11 boys and 15 girls could distinguish spoken words. Of the 56 whose hearing was tested, 28 could hear better with the left ear and 14 with the right, while 11 heard alike in both.

— It is much to be feared that, after all the stir which has been made about it, the Antarctic expedition which was to have been sent out next year, at the joint expense of the Australian colonies and Baron Oscar Dickson of Gothenburg, may have to be dropped owing to the supineness of the Australians. In July last it was announced that the Queensland Government was to place £2,000 in the colonial estimates as a contribution to the expedition. Sir Henry Parkes undertook to get £2,000 from New South Wales, while from Victoria a sum was expected commensurate with the importance of that colony. Sir Thomas Elder also promised £5,000 on certain conditions, while Baron Oscar Dickson undertook to give another £5,000, and, indeed, was quite prepared to spend double that amount to insure that the expedition should be a success. What with cash and promises, the sum of £14 000 seemed secure in July last, and it was confidently expected that £2,000 should be raised, so as to be well over the £15,000 which it was calculated the expedition would cost. Baron Nordenskjold was quite prepared to take charge of the expedition; and, as stated in the London *Times*, Baron Dickson had actually selected the two ships which he thought suitable for the work. Now we learn that the Queensland Parliament has refused to pass the vote of £2,000 which was placed upon the estimates. It is not only the direct loss of this subscription which is to be deplored, but it affects the other promises, which were made conditionally. Baron Dickson's offer of £5,000 lapses at the end of this month, and as he has had no information from Australia that the remainder of the £15,000 is secured, he has probably made up his mind that the whole scheme has fallen through, as did the similar proposal a few years ago. Indeed, it would seem as if Baron Dickson had not been treated with the courtesy which might have been expected. He had not been informed of the progress of matters in Australia, and has received no certain information as to the actual state of the movement. The fact is, the movement seemes to have been sadly mismanaged. No proper steps have been taken to enlist the sympathies and the active support of the public in Australia, where there is plenty of money to spare for purposes of this kind. True, one or two newspapers appear to have supported the proposal with some energy, but much more is wanted than that in Australia, where evidently the public is not too enthusiastic for the promotion of knowledge. The leaders of the movement on behalf of the proposed Antarctic expedition seem to have been a few members of learned societies, not quite in touch with the general public. The result is that the wealthy Australian colonies have been placed in the ridiculous position of having appealed to a small nation like Sweden for assistance, and in the end have been unable to fulfil the conditions on which that assistance was asked. It is to be hoped that it is not yet too late to lead the movement to a more worthy result.

— The *Telegram Herald* of Grand Rapids says that the tallest men of Western Europe are found in Catalonia, Spain; Normandy, France; Yorkshire, England; and the Ardennes districts of Belgium. Prussia gets her tallest recruits from Schleswig-Holstein, the original home of the irrepressible Anglo-Saxons; Austria from the Tyrolese highlands. In Italy the progress of physical degeneration has extended to the upper Appennines, but the Albanian Turks are still an athletic race, and the natives of the Caucasus are as sinewy and gaunt as in the days of the Argonauts. In the United States the thirty-eighth parallel, ranging through Indiana and northern Kentucky, is as decidedly the latitude of big men as the forty-second is that of big cities. The tallest men of South America are found in the western provinces of the Argentine Republic, of Asia in Afghanistan and Kaypooana, of Africa in the highlands of Abyssinia.

— A correspondent of the *Times of India*, referring to recent long fasts in this country, says that in India fasts of thirty to forty days are common among the Jains, from among whom, once in each year, some individual comes forward and undertakes to fast thirty-five, forty, and even sixty days. They do this with nothing but warm water to drink, and will die rather than take food during the prescribed period. Quite recently two Jains of Bombay fasted, one for sixty-one, the other for forty-eight days, at the end of which time, having been congratulated by twenty-five thousand Jains who went for the purpose, they recommenced taking food in the manner prescribed in their own books and shastras. On Sept. 22, in commemoration of this event, all the chief bazaars in Bombay were closed, and about five thousand Jains, male and female, fasted all day, while a large sum was spent in securing the release of cows and other animals from the slaughter house at Bandora.

— At a meeting of the Chemical Society of Washington, Dec. 10, Professor Wiley and W. H. Krug presented papers on the "So-called Floridite." Professor Wiley described the location and the occurrence in Florida of the samples which had been sent him by Professor Cox. Some of the specimens, he said, were amorphous masses of almost pure tri-calcium phosphate, others were mixtures, but containing chiefly that compound. He thought it ought not to be defined as a mineral species. He said undue importance had probably been ascribed to commercial fertilizers as plant foods, as experience has demonstrated that mineral phosphates are not readily absorbed by plants even when in a finely divided state, but need to be decomposed by the action of sulphuric acid. The most refractory phosphates, however, with plenty of time are utilized by the plants. Florida phosphates seemed especially capable of assimilation in the natural state, and experiments in the use of the natural product were now going on at the sugar station of Runymede, Florida. Mr. Krug spoke of the methods of analysis, gave details of the process as described at a previous meeting, and presented the results of the analyses (Dr. T. M. Chatard, "Notes on the Analyses of phosphate rocks"). He agreed with Professor Wiley as to the non-existence of floridite as a definite species. His paper referred mainly to the determination of fluorine in phosphate rocks, and the method employed is a modification of the Boezelius silica fusion method. Instead of using ammonium carbonate to remove silica and alumina from the alkaline solution, the saturation of the solution with carbonic acid under pressure has been found to give very satisfactory results. He had reason to think that the method might be still further simplified. Discussion of the two papers was by Professor Clarke and Dr. Schneider. Professor Clarke thought the determination of a mineral species did not depend upon crystallization, as many amorphous minerals, such as torquois, serpentine, and talc were good species Whether it is a distinct chemical compound, is the best basis of determination. If among the phosphates is found a tri-calcium phosphate by itself, he thought it ought to be a mineral species, no matter what its derivation. Dr. Schneider described a series of analyses he had made to determine the influence of different quantities of fluorine on the loss of silica when evaporated with varying amounts of liquid. In a paper on "Meat Preservatives," I. T. Davis gave the following list of preservative agents: salt, potassium nitrate, sulphurous acid, benzoic acid, saccharine, salycilic acid, hydro-napthole. The author described their action and the means of their detection. W. F. Hillebrand and Wm. H. Melville presented a paper "On the Isomorphism and Composition of Thorium and Uranous Sulphates."

— A meeting was held in the Lecture Room of the Brooklyn Institute, 502 Fulton Street, on Saturday evening, Dec. 26, at eight o'clock, for the purpose of organizing a Brooklyn Numismatical Society as a Section of the Brooklyn Institute. The purposes of the society will be the collection of coins, medallions, and kindred works of art, the conduct of courses of lectures on numismatics, the formation of a library of reference on the subject, and to enable students and specialists in numismatology to become better acquainted with one another. Dr. Charles E. West, president of the Archæological Society of the Institute, gave a brief illustrated lecture on "Ancient Coinage" after the organization of the section.

— In the interesting paper on insectivorous plants, read before the Royal Horticultural Society on Sept. 22, 1891, and reported in *Nature*, Mr. R. Lindsay refers to the experiments by which Mr. Francis Darwin has shown the amount of benefit accruing to insectivorous plants from nitrogenous food. Mr. Lindsay says his own experience in the culture of Dionæa is that when two sets of plants are grown side by side under the same conditions in every respect, except that insects are excluded from the one and admitted to the other, the latter, or fed plants, are found to be stronger and far superior to the former during the following season. He points out the importance of remembering that the natural conditions under which these plants are found are different from what they are under cultivation. In their native habitats they grow in very poor soil and make feeble roots, and under these conditions may require to capture more insects by their leaves to make up for their root deficiency. Under culture, however, fairly good roots for the size of plant are developed. "Darwin," says Mr. Lindsay, "mentions that the roots of Dionæa are very small: those of a moderately fine plant which he examined consisted of two branches, about one inch in length, springing from a bulbous enlargement. I have frequently found Dionæa roots six inches in length; but they are deciduous, and I can only conjecture that the roots mentioned by Darwin were not fully grown at the time they were measured. What is here stated of the natural habits of Dionæa applies more or less to all insectivorous plants."

— At a recent meeting of the New York Academy of Medicine a popular address was delivered by Professor Charles F. Chandler on "Arsenic in Common Life." In this address, as reported in *Medical News*, he devoted himself to the task of exploding the widely prevalent idea, both in lay and professional circles, concerning the dangers from arsenic in wall-paper. He said that he had himself believed in it without ever making any special investigation, up to the time when his duties in connection with the Board of Health required him to make it a special study. He then found that the idea had been started by a botanist, and that it was based on the most flimsy reasoning. He next made some experiments in the laboratory by passing air over sheets of paper —some moist and others dry—coated with Paris green. Not a trace of arsenic was found in this air. Much of his address was devoted to a narration of cases that had occurred in Boston during a time when the people in that city were much excited over the supposed dangers from arsenical wall-paper. The most important case was that of an ex-mayor of Boston, who had been supposed to be suffering for a long time from this form of poisoning, but the post-mortem examination showed that he had died from cancer of the stomach. The wall-paper that had been supposed to be the source of the poisoning in his case had not been changed from 1817 to 1891. While it is quite possible that, in the old-fashioned wall-paper, the arsenical dyes were loosely attached to the paper, the arsenic might become detached and diffused through the air, the amount would ordinarily be quite insignificant; and in the wall-papers made in the last fifteen years no arsenical pigments have been used, and the presence of arsenic in these papers, as determined by delicate chemical tests, is due entirely to accidental impurities. Some of the papers that were thought to have caused poisoning had been on the walls for thirty or forty years. Supposing, for the sake of argument, that there were sixty square yards of paper in a room, each yard containing one grain of arsenic—the amount found in several of the cases quoted—and that during a period of thirty years *all* the arsenic had left the wall-paper and had entered the human system without any being lost, this would be at the rate of one grain in six months, or only $\frac{1}{180}$ of a grain in each twenty-four hours. Many distinguished scientists have independently investigated this subject of poisoning from arsenical wall-paper, and they all agree in saying that there is "nothing in it."

— The *Meteorologische Zeitschrift* for November contains a summary, by Dr. J. Hann, of the meteorological observations taken at Cairo from 1868-88. The observations have been published *in extenso*, together with a good introduction upon the climate, in the Bulletin of the Egyptian Institute, and although similar observations have occasionally been published before, the present series contains much new and useful material. The most striking feature in the climate of this part of Egypt, as we learn from *Nature*, is the *Chamsin*, the hot and dust-bearing wind which makes its appearance in March or April for about three to four days at a time, and robs a large portion of the trees of their leaves. In the intervals during which this wind is not blowing the weather is pleasant and clear during spring-time, and the nights fresh and calm. During the summer the north winds prevail, with high temperature, very clear air, and great dryness. Towards September humidity appears with the rise of the Nile, the ground is at times covered with heavy dew, and the heat becomes oppressive on account of the moisture. In October and November fog occasionally occurs in the morning, and rain begins to fall. After this season the temperature is uniform and pleasant. Snow is unknown, frost very seldom occurs, and rain is not very frequent. The absolute maximum temperature of the 21 years' period was 117° in August, 1881, which was also closely approached in May, 1880, viz., 116.4°. The absolute minimum was 28.4° in February, 1880, and the mean annual temperature was 70.5°. Rainfall is only given for the years 1887-88, in which 0 87 and 1.67 inches fell respectively. The relative humidity sinks at times even on a daily average to 12 per cent, and has been known to fall as low as 3 per cent at certain hours. Thunder-storms and hail are very rare. The original work contains a long investigation on the connection between the height of the Nile and the weather, a comparison between the present climate and that at the beginning of this century, and several carefully prepared diagrams referring to all meteorological elements.

— At the monthly meeting of the Royal Meteorological Society, Dec. 16, Mr. W. Marriott gave the results of the investigation undertaken by the society into the thunder-storms of 1888 and 1889, which he illustrated by a number of lantern slides. The investigation was originally confined to the south-east of England, but as this district was found to be too circumscribed, it became necessary to include the whole of England and Wales. After describing the arrangements for collecting the observations and the methods adopted for their discussion, Mr. Marriott gave statistics showing the number of days on which thunder-storms occurred at each station; the number of days of thunder-storms in each month for the whole country; the number of days on which it was reported that damage or accidents from lightning occurred; and also the number of days on which hail accompanied the thunder-storms. In 1888 there were 113 days and in 1889 123 days on which thunder-storms occurred in some part of the country. The number of days with damage by lightning was 33 in 1888 and 38 in 1889; and there were 56 days in each year on which hail accompanied the thunder-storms. The tables of hourly frequency show that thunder-storms are most frequent between noon and 4 P.M., and least frequent between 1 A.M. and 7 A.M. Thunder-storms appear to travel at an average rate of about 18 miles per hour in ill-defined low barometric pressure systems, but at a higher rate in squally conditions. The author is of opinion that individual thunder-storms do not travel more than about 20 miles; and that they take the path of least resistance, and are consequently most frequent on flat and low ground. Detailed isobaric charts, with isobars for two-hundredths of an inch were prepared for 9 A.M. and 9 P.M. each day for the month of June, 1888. An examination of these charts showed that instead of the pressure being so very ill-defined, as appeared on the daily weather charts, there are frequently a number of small, but distinct areas of low pressure, or cyclones, with regular wind circulation; and that these small cyclones passed over the districts from which thunder-storms were reported. Sometimes it is not possible to make out well-formed areas of low pressure from two-hundredths of an inch isobars, but there is a deflection of the wind which shows that there is some disturbing cause; and thunder-storms have usually occurred in that immediate neighborhood. The author believes that the thunder-storm formations are small atmospheric whirls, in all respects like ordinary cyclones; and that the whirl may vary from 1 mile to 10 miles or more in diameter. There are frequently several whirls near together, or following one another along the same track. The numerous oscillations in the barometric curve are evidently due to the passage of a succession of atmospheric whirls; and it appears that lightning-strokes are most frequent when these oscillations are numerous Mr. F. J. Brodie read a paper "On the Prevalence of Fog in London during the Twenty Years 1871 to 1890." The popular notion that November is *par excellence* a month of fog is not confirmed by the figures given by the author. The number of fogs in that month is, if anything, slightly less than in October or January, and decidedly less than in December, the last-mentioned month being certainly the worst of the whole year. The latter part of the winter is not only less foggy than the earlier part, but is clearer than the autumn months. In February the average number of days with fog is only 6.6, as against 8.9 in January, 10.2 in December, 9 2 in October, and 8.8 in November.

— A paper on "Siouan Onomatopes," by J. Owen Dorsey, was read before the Anthropological Society of Washington, D.C., Dec. 1, 1891. According to "The Century Dictionary," "an onomatope is a word formed to resemble the sound made by the thing signified." Mr. Dorsey finds in the Siouan languages many onomatopetic roots, hence he suggests the modification of the definition just given, making it read, "An onomatope is a word *or root* formed to resemble the sound made by the thing signified" In the paper under consideration, the author gives examples of onomatopes in seven languages of the Siouan or Dakotan family: Dhegiha, Kwapa, Kansa, Osage, Tciwere, Winnebago, and Dakota, all but the Dakota having been collected by himself since 1871. In these languages, according to the author, there are sundry permutations of sound, among which are *sh* and *kh*, *gh* and *z*, *dh* and *n*. The words in which these permutations occur are not always synonyms; but when we find a word in which, for example, *sh* is used, we may safely infer that the language contains another word differing from the former only in the substitution of *kh* for *sh*, or that one language or dialect uses *sh* where another employs its correlative, *kh*. Most of the onomatopes found by the author are dissyllabic, a few being monosyllabic and polysyllabic. Some of the onomatopes were given with the notations of their respective sounds as they appear to the Indian ear; thus, the sound of the plane and drawing-knife (*s-s-s*) becomes the root *s'u*; whence the verbs, *ba-s'u*, to use a plane; and *dhi-s'u*, to use a drawing-knife. The sound of a waterfall, of sawing wood, etc., is *kh* + (a prolonged sound), the onomatope being *khu'-'e* in Dhegiha, *khu'-wa-d^{ahe}* in Kansa, *khu'-we* in Kansa and Osage, *kho'-kh'e* in Tciwere, and *sho* + *kh* in Winnebago (the o in the last being prolonged). The creaking of new shoes or the sound of fiddle-strings (*gi-gi-gi*) evidently suggested the root *gi'-ze*; whence *ba-gi'ze*, to play a fiddle; and *nan-gi'ze*, to make (new shoes) creak by walking (in them). Many other examples were given; but the reader is referred to the *American Anthropologist* for January, 1892, for the full article.

— Among the recent appointments of Johns Hopkins graduates are Alfred Bagby, Jun. (Ph.D., 1891), adjunct professor of ancient languages, South Carolina College; Edward A. Bechtel (A.B, 1888), professor of Latin, Yankton College, South Dakota; Hiram H. Bice (A.B., 1889), instructor of languages, Blackburn University, Carlinville, Ill.; Richard N. Brackett (Ph.D., 1887), associate professor of chemistry, Clemson Agricultural College, S.C.; J. Douglas Bruce (graduate student, 1889–90), associate in Anglo-Saxon and Middle English, Bryn Mawr College; Norman W. Cary (graduate student, 1889–91), instructor in biology, geology, and astronomy, Wilson College, Chambersburg, Pa.; Frank A. Christie (fellow, 1885–86), lecturer on New Testament literature, Harvard Divinity School; Henry L. Coar (graduate student, 1884–86), mathematical master, Smith Academy, Washington University, Mo.; Charles Edward Coates, Jun. (A.B., 1887, Ph D., 1891), professor of chemistry, St. John's College, Md.; John R. Commons (graduate student, 1888–90), associate professor of political economy, Oberlin College; Starr W. Cutting (graduate student, 1890–91), professor of French and German, Earlham College; L. Bradley Dorr (A.B., 1890), adjunct professor of chemistry, Niagara University, Buffalo, N.Y.; Hermann L. Ebeling (A.B., 1882, fellow, 1890, Ph.D., 1891), professor of Greek, Miami University; William A. Eckles (graduate student, 1889–91), professor of Greek, Ripon College; George S. Ely (fellow, 1881–83, Ph.D., 1883), principal examiner, U. S. Patent Office; Alfred Emerson (fellow, 1882–84, instructor, 1884–85), associate professor of classical archæology, Cornell University; Andrew Fossum (Ph.D., 1887), classical instructor, Drisler school, New York City; William R. Fraser (graduate student, 1888–91), instructor in classics, University of Nebraska; Thomas P. Harrison (fellow, 1890-91, Ph.D., 1891), associate professor of English, Clemson Agricultural College, S.C.; Arthur S. Hathaway (fellow, 1882–83), professor of mathematics, Rose Polytechnic Institute; George A. Hench (fellow, 1888–89, Ph.D., 1889), assistant professor of Germanic philology, University of Michigan; Charles C. Henschen, (graduate student, 1890–91), instructor in Girard College, Philadelphia; Benjamin C. Hinde (graduate student, 1888–90), professor of physics, Trinity College, N.C.; Clifton F. Hodge (fellow, 1888–89, Ph.D., 1889), instructor of biology, University of Wisconsin; Walter J. Jones (A.B., 1888, Ph.D., 1891), professor of chemistry, Wittenberg College, O.; Henry W. Keating (A.B., 1891), principal, Centreville Academy, Md.; Andrew C. Lawson (fellow, 1886–87, Ph.D., 1888), assistant professor of geology and mineralogy, University of California; Frederick S. Lee (fellow, 1884–85, Ph.D., 1885), demonstrator of physiology, College of Physicians and Surgeons, N.Y.; Felix Lengfeld (fellow, 1887–88, Ph.D., 1888), instructor in chemistry, University of California; A. Stanley Mackenzie (fellow, 1890–91), lecturer in physics, Bryn Mawr College; Arthur W. McDougall (A.B., 1891), financial secretary, Associated Charities of Cincinnati; John H. T. McPherson (A.B., 1886, fellow, 1889–90, Ph.D., 1890), professor of history, University of Georgia; W. Howard Miller (A.B., 1888), instructor in mathematics, Leland Stanford University; Thomas H. Morgan (fellow, 1889–90, Ph.D., 1890, Bruce fellow, 1890–91), associate professor of biology, Bryn Mawr College; Wilfred P. Mustard (fellow, 1890 91, Ph.D., 1891), professor of Latin, Colorado College; Charles A. Perkins (fellow, 1883–84, Ph.D., 1884), professor of physics, Hampden Sidney College; E. D. Preston (fellow, 1876–78), is engaged at Honolulu, probably for a year, working under the joint auspices of the International Geodetic Association of Europe and the U. S. Coast and Geodetic Survey; Herbert E. Russell (graduate student, 1886–87), associate professor of mathematics and natural sciences, University of Denver; A. Duncan Savage (fellow, 1876–79), instructor in the history of art, Farmington, Conn.; Edward M. Schaeffer (graduate student, 1883–85), professor of physical culture, Washington and Lee University; Henry Sewall (fellow, 1878–79, associate, 1879–82, Ph.D, 1879), professor of physiology, University of Denver; Sidney Sherwood (Ph.D., 1891), instructor in finance, University of Pennsylvania; Ernest G. Sihler (fellow, 1876–79, Ph.D., 1878), professor of ancient languages, Concordia College, Milwaukee; Henry D. Thompson (fellow, 1886–87), assistant professor of mathematics, Princeton College; William L. Weber (graduate student, 1890–91), professor of English, Southwestern University, Texas; Benjamin W. Wells (fellow, 1881), professor of modern languages, University of the South; John White, Jun. (A.B., 1888, fellow, 1890–91, Ph.D., 1891), assistant in chemistry, Cornell University; Henry V. Wilson (A.B., 1883, fellow, 1887–88, Ph.D., 1888, Bruce fellow, 1888–89), professor of biology, University of North Carolina; Edmund B. Wilson (fellow, 1879–80, Ph.D, 1881, assistant, 1881–82), adjunct professor of biology, Columbia College; John R. Wightman (fellow, 1886-87, Ph.D., 1888), associate professor of romance languages, University of Nebraska; Arthur C. Wightman (fellow, 1887–88, Ph.D., 1889, demonstrator, 1889-90), assistant professor of biology, Randolph Macon College.

— Professor Stas, the eminent Belgian chemist, has died at the age of seventy-eight.

— According to information sent to Berlin, says the *Times*, Emin Pasha and Dr. Stuhlmann, travelling in the region between Lakes Victoria, Tanganyika, and Albert Edward, have discovered what they take to be the ultimate source of the Nile. This is a river called Kifu, which is supposed to have its sources in the Uhha country, lying to the east of the northern part of Lake Tanganyika, about 4° of south latitude. It flows into the southern end of Lake Albert Edward. It is not stated that Emin and Dr. Stuhlmann have actually followed the course of the river. They have no doubt encountered it on their journey from Victoria Nyanza towards the other lake and followed it down to its mouth. If the course which they lay down for it is correct, it will compel us to alter the hydrography on our maps of this region. There is no mention of the Lake Kifu, between Tanganyika and Albert Edward, to be found in existing maps; and it is well known that the African natives rarely distinguish between a river and a lake,— Nyanza, in the language of Central Africa, standing for both. The still larger lake, Akanyaru, or Alexandra Nyanza, as Mr. Stanley named it, may very probably also have to be removed. No white traveller, so far as is known, has ever seen it; Mr Stanley placed it down on his map from native report. It may simply be an expansion of the Kifu, and not the source of the Kagera, which flows into the west side of Victoria Nyanza. The Kagera will thus lose much of its importance as a remote feeder of the Nile, and the Kifu may possibly become its most southerly source. But it should be remembered that when Mr. Stanley was marching northwards to the Victoria Nyanza in his great journey across Africa, he came upon a river in about 5° south latitude which he believed flowed into the south shore of the lake under the name of Shimeeyu. Mr. Stanley struck this river at only one or two points, and these may really have belonged to different rivers. At all events, on the most recent maps the Shimeeyu is sharply deflected to the east from its mouth in the lake, and there is no river rising in 5° south latitude, which flows into the Victoria Nyanza. Probably we have not heard the last word about the ultimate sources of this strange river, about the position of which Ptolemy, after all, was not so far wrong. We have first the Kifu rising in about 4° south latitude, running into Lake Albert Edward, issuing thence as the Semliki, and feeding Lake Albert. There it mingles with the Victoria Nile from Lake Victoria, and together they issue from Lake Albert as the White Nile, which, before it reaches Khartoum, is augmented by a multitude of tributaries from the west. Whether the Shimeeyu or the Kifu be its most remote southern feeder, the river flows through 36 degrees of latitude. The full details of this journey of Emin will be awaited with interest, especially if he continues to fill in the blanks on our maps and to complete our knowlege of one of the most remarkable rivers of the world.

— Professor Thomas F. Hunt of the Pennsylvania State College has accepted the invitation to occupy the chair of agriculture in the Ohio State University after Jan. 1, 1892.

— Dr. E. von Esmarch, son of Professor v. Esmarch of Kiel, has been appointed professor of hygiene in the University of Königsberg, in the room of Professor C. Fränkel, who has gone to Marburg.

— Mr. Robert P. Bigelow (S B., Harvard University, 1887) has been appointed to the Adam T. Bruce fellowship in biology, in place of Dr. Thomas H. Morgan, who has resigned the fellowship to accept the position of associate professor of biology at Bryn Mawr College.

SCIENCE:

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Attention is called to the "Wants" column. All are invited to use it in soliciting information or seeking new positions. The name and address of applicants should be given in full. so that answers will go direct to them. The "Exchange" column is likewise open.

THE KLAMATH NATION.

I.—THE COUNTRY AND THE PEOPLE.

"THE Klamath Indians of South-Western Oregon" is the second title of the recently published work, by Albert Samuel Gatschet, which forms, according to its leading title, Vol. II. of "Contributions to North American Ethnology," one of the several series of works issued by the "United States Geographical and Geological Survey of the Rocky Mountain Region, J. W. Powell in Charge." The term "volume," however, is in this case to be understood in a special sense. The work really appears in two substantial tomes in quarto. comprising over seven hundred pages each, and distinguished as Parts I. and II. The too brief "table of contents" informs us that Part I. contains the writer's "letter of transmittal," and an "ethnographic sketch," with "texts," and "grammar;" while Part II. is entirely occupied by the "Dictionary — Klamath-English, and English-Klamath." This curt statement gives but a slight idea of the importance of the work as a contribution of the first order to ethnological science.

The Klamath River rises in the southern interior of Oregon, at a distance of about three hundred miles from the Pacific. First traversing an extensive morass, known as Klamath Marsh, it passes through Upper Klamath Lake, a charmingly picturesque sheet, some twenty-five miles long by five or six miles in breadth; then receiving a tributary from the Lower Klamath Lake, it crosses the State boundary into California, and, after a winding course of two or three hundred miles, falls into the ocean near the north-eastern angle of that State. Several tribes of different lineage and languages dwell, or formerly dwelt, along this stream, and have borne indiscriminately from the river's name (the origin and meaning of which are uncertain) the appellation of Klamath Indians But this designation is more usually restricted to the people who possess the upper waters of the river and the great Klamath Lake, and who, as is the case with many other Indian tribes, have no special distinguishing name for themselves except that of "man,"— in their language, *Maklaks*. Another name which has been given to them is *Lutuami*, meaning Lake Indians, which is in no way distinctive. The author has therefore judiciously decided to retain the usual appellation, "the Klamath Indians," adding the description "of South-western Oregon," to distinguish them from the Californian Klamaths. As these, however, have their proper tribal names of Shasti, Karok, Hupa, and Yurok or Alikwa, it is likely that the designation of Klamath will in time be wholly restricted to the Oregon nation bearing this name.

The title of "nation" is one which, as the author suggests in his "letter of transmittal" to Major Powell, may properly be conferred upon this remarkable people. Their claim to this title does not reside in their numbers, which at present hardly reach nine hundred souls, nor in their territory, though this, even in their diminished reservation, covers fifteen hundred square miles. But they have the distinction, like the Basques of south-western Europe, of composing a separate "stock," possessing a language, a mythology, and a social system peculiar to themselves. Such a stock, inhabiting a compact territory, and having (as the Klamaths had till lately) their own government, may justly claim to be considered a nationality. The claim, however, is in America not so notable as it would be deemed in Europe, where distinct linguistic stocks are so few. Mr. Gatschet gives a list of twenty-two of these stocks, radically distinct in grammar and vocabulary, which have been found in Oregon and California alone. If to these we add the stocks of Washington State and of British Columbia, the number of such aboriginal nations found along the Pacific coast of North America will not be less than twenty-eight, nearly equalling the total number of stocks in Asia and Europe combined. There is reason to believe that a careful study of the immensely varied languages, physical and moral traits, mythologies, and social systems of these twenty-eight primitive nationalities would greatly modify and in some respects transform the sciences of ethnology and linguistics. There have been many partial and fragmentary attempts at such a study, some of them possessing much value. But that of Mr. Gatschet is undoubtedly the fullest and most minutely accurate that has thus far been made of any single stock.

The Klamath country is a region of mountains, lakes, and upland plains, stretching eastwardly into the interior from the lofty "Cascade Range," and elevated from four to seven thousand feet above the level of the sea. The author was naturally reminded of his native Switzerland by the grandeur of the scenery in the western portion of the reservation, "where the towering ridge of the Cascade Mountains and the shining mirrors of the lakes at their feet confront the visitor, surprised to see in both a reproduction of Alpine landscapes in the extreme west of America." It might be added that in the people themselves we recognize the well-known traits of mountaineers, as we trace them from the Scottish Highlands to Montenegro, and from the Caucasus to the Pamir,— the intense local attachment, the spirit of independence, the desperate bravery in the defence of their homes, the frugality, and the strong conservatism.

The Klamath people are divided into two septs, the Klamath Lake tribe, who call themselves Eukshikni ("of the lake") and the Modocs, who twenty years ago acquired a dismal notoriety by the "tragedy of the Lava Beds," — an event, or series of events, which aroused horror at the time, but in which, according to the judgment of the best-informed historians, including Mr. Gatschet, they were more sinned against than sinning. An eminently fair-minded historical writer, Mr. J. P. Dunn (author of "The Massacres of the Mountains"), in his account of the Modoc outbreak, gives a pithy and graphic description of this sept, in terms which, with some modification, will apply to the whole nation. "They were a peculiar people; good-natured as a rule, but high-tempered; industrious, and yet as haughty as the laziest Indians on the continent. They had more of that commendable pride which makes men desire to be independent and self-respecting than any of their neighbors. They were inclined to be exclusive in their social relations, but even among themselves there was little merrymaking. They took a more serious view of life and its duties. Stubbornness and strong will were tribal characteristics. In features they were rugged and strong, the cheek-bones large and prominent, the hair thick and coarse, the face heavy and not much wrinkled in old age." Of their congeners, the "Upper Klamaths," the same writer says, "They were a finely formed, energetic, and cleanly race." Mr. Gatschet confirms in general these descriptions, but adds: "The Mongolian features of prognathism and of high cheek-bones are not very marked in this upland race, though more among the Modocs than in the northern branch. If it were not for a somewhat darker complexion and a strange expression of the eye, it would be almost impossible to distinguish many of the Eukshikni men from Americans." Their complexion is so nearly white that "blushing is easily perceptible, though the change in color is not great." The hair is straight and dark; and he remarks, "I did not find it very coarse, though with many Modoc women it is said to be so, and to grow to an extreme length."

It is worthy of note that the complexion and other physical characteristics of the Indians of western America vary in marked connection with the "environment," that is, with the climate, food, and mode of life. The natives of northern British Columbia, the Thlingits (or Thlinkeets) and Haidas, are as light of hue as Europeans. They often have ruddy cheeks, brown or blue eyes, and red or brown and wavy or curly hair. As we pass southward along the coast, successively to the Nootkans, the Chinooks, and the other tribes of southern British Columbia, Washington, Oregon, and northern California, we find the hue of the skin deepening, the eyeballs darkening, and the hair becoming coarser, until at length, under the tropical heats of central and southern California we come to tribes with almost negroid traits. These traits are described by the best authority, Mr. H. H. Bancroft, as "a complexion much darker than that of the tribes further north, often very nearly black;" "matted bushy hair;" "a low, retreating forehead, black, deep-set eyes, thick, bushy eyebrows, salient cheek-bones, a nose depressed at the root and somewhat wide-spreading at the nostrils, a large mouth, with thick, prominent lips, teeth large and white, but not always regular, and rather large ears." But when we recede from the low, hot, and moist coast to the cool and dry interior uplands, the people, as in the case of the Klamaths, return to the European type. Mr. Gatschet describes particularly the small mouth of the Eukshikni, the good teeth, and the genuine Grecian profile, "the nasal ridge not aquiline but strong, and forming an almost continuous line with the forehead."

The truth is that, as one of the acutest of German anthropologists, Oscar Peschel, in his able and comprehensive treatise on the "Races of Man," has affirmed, all attempts to distinguish the various so-called races by merely physical characteristics, whether of color, hair, or the osseous framework, have proved utterly futile. As regards the shape of the head, on which so much stress has been laid, the view maintained by the late S. G. Morton, that the natives of this continent had a peculiar form of cranium, different from that of any other people, has been shown, first by Sir Daniel Wilson in his "Prehistoric Man," and later by Dr. Virchow, in his recent work, "Crania Ethnica Americana," to be wholly incorrect. Dr. Virchow declares (in his summary read before the Congress of Americanists, at Berlin, in 1888) that he finds dolichocephalic, mesocephalic, and brachycephalic tribes scattered throughout the continent; and he pronounces in positive terms his conviction that "the cephalic index, calculated on measures of the length and breadth of the cranial vault, should not be admitted as a determining proof of the single or diverse origin of populations."

We may confidently anticipate that the series of physical measurements of all the American tribes, which, by a happy thought, Professor Putnam has instituted for the Columbus World's Fair, and on which many observers are now engaged, under the experienced supervision of Dr. Franz Boas, will result in confirming the views of Peschel, Wilson, and Virchow, and establishing the truth that physical characteristics afford no proper tests of racial affinity or diversity. We are thus brought back to the older, and, as time has proved, the infinitely stronger evidences of what may be styled the intellectual characteristics, language and mythology. That these tests sometimes fail, through mixture of stocks and adoption of foreign beliefs, is unquestionable; and we are then left in ethnology, as we are often left in other sciences — astronomy, geology, and physiology, for example — to rely on probabilities. But so far as certainty is attainable, as it often is, it can only be attained through the evidence of these special tests.

The language and mythology of the Klamath nation are of a highly interesting character; but our study of these subjects, with the ample materials and philosophic suggestions furnished by Mr. Gatschet, must be left for other articles.

HORATIO HALE.

Clinton, Ontario, Canada.

ANOTHER RIVER-PIRATE.

IN *Science*, vol. xiii., 1889, p. 108, under the title of "A River-Pirate," Professor W. M. Davis described a recent case of river capture in south-eastern Pennsylvania, brought about by the backward gnawing of one stream into the drainage area of another. In looking over with him the Doylestown sheet of the Pennsylvania Topographic Survey there were found numerous cases of similar capture, either already accomplished or about to take place, and at his suggestion the writer recently made a visit to the district in question, in the hope of being able to add something more to the history of the rivers of Pennsylvania.

The region of these migrations, Buck County, is situated in the north-eastern part of Pennsylvania (see Fig. 1), and extends for thirty-three miles (in a straight line) along the Delaware River. It is a gently rolling, well-cultivated country, composed of Mesozoic new red sandstones and shales, dipping from 5° to 15° to the north-west, the hard and soft layers of reddish sand and mud alternating. The evidence goes to show that the surface of the country has been reduced by erosion at least 1,000 feet since the time when the beds were laid down, for the upper deposits must have once overspread the gneiss ridge at the northern county line. They still rise nearly to its top, and there is no evidence of a fault, the absence of any trace of it being capable of explanation only on the supposition that extensive erosion has taken place.[1]

[1] 2d Geol. Survey of Penn. 1885.

The evidence from New Jersey and Pennsylvania goes to show that after the tilting of the sandstones there came an extensive period of denudation, which resulted in the production of a more or less perfect plain, the so-called Cretaceous base-level, which can be seen in the level tops of the New Jersey Highlands and of the ridges of Pennsylvania. Following this came an elevation, giving the streams renewed energy, and resulting in the etching out of the softer rocks down to another peneplain, the Tertiary base-level. Finally another elevation gave the streams another period of activity, and it is in this cycle that we find them to-day. The larger streams, like the Delaware, have already sunk

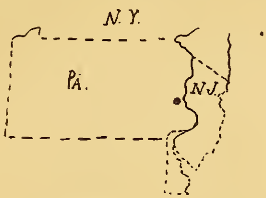

Fig. 1.

their channels well into the Tertiary peneplain. It is with some of the smaller ones that we have now to deal.

Unless something had occurred to interfere with their work in the previous cycle, which ended in the production of the Tertiary peneplain, the streams of this district should now be well adjusted to the structure. On examining the map, however, we find that many of them show a tendency to deflect downstream as they run towards the Delaware. Such an arrangement is characteristic of the tributaries of flood-plained master-streams, as is well shown in the case of the Mississippi and the Po, and may perhaps be explained in this case by the flood plaining of the Delaware during the Tertiary period of base-levelling. Had such a flood-plaining occurred before, i.e., during the Cretaceous base-levelling epoch, the side streams would have already become adjusted to the structure, for since Cretaceous time the whole surface of the country has been worn down some hundreds of feet. Flood-plaining such as that believed to have taken place here, seems to be characteristic of large rivers during the last stages of base-levelling, when, with a very gentle slope, they build their deltas up-stream from their mouths, covering the country on both sides with alluvium.[1]

The flood-plaining of the Delaware would give the side-streams a superimposed course on the Tertiary peneplain, and as they cut down through the cover they would find themselves flowing across the outcropping edges of the underlying strata of sandstone and shale. An arrangement of strata such as that here presented gives an admirable field for the adjustment of streams. It can be readily seen that if a side stream works back along the strike of one of these beds, it has, especially if the bed is soft, a much easier course than a stream which has to cross the edges of many hard and soft strata on its way to join the master. Perhaps this may be more easily understood from the accompanying figure (Fig. 2), reduced from the contoured map of the Pennsylvania Geological Survey, representing the district under consideration.

[1] W. M. Davis: "The Geological Dates of Origin of Certain Topographic Forms on the Atlantic Slope of the United States" (Bulletin Geol. Soc. of America, Vol. 2, p. 530); "The Rivers and Valleys of Penn." (Nat. Geog. Mag., Vol. 1, No. 3); "The Geographic Development of Northern New Jersey" (Proc. Boston Soc. Nat. Hist., XXIV., 1889).

In this case Tohickon Creek, only the lower part of which is shown, has its course directly across the strike of the beds down to the Delaware, while Tinicum Creek goes along the strike for some distance and thus has an easier course. The result has been that a branch of the Tinicum has gnawed its way back along the strike until it is now within less than half a mile of the Tohickon. The Tohickon has a descent of somewhat over twenty feet in the first mile from this point, while the branch of the Tinicum falls over eighty feet in the same distance. The distance from the present divide to the Delaware is about eight miles along the Tohickon, and about five miles along the Tinicum. It is seen, then, what an advantage the little branch of the Tinicum has over its larger rival. The region where the contest is going on is just south of the letter *A* in the figure, and as the more favored stream works its way further and further back, the divide will be pushed over the intervening space, and before long the Tohickon will be captured and led out by a shorter and better course through the Tinicum, leaving its lower part, beheaded, to continue its way down the Tohickon valley. The region of the divide is pretty level, being all enclosed by the 300 feet contour, with a slight slope toward the Tohickon, and a greater one toward the Tinicum, and if we get this idea of migration clearly in mind, it seems almost as if we could see the divide moving toward the Tohickon. There are few trees to protect the surface there, and the crops of potatoes and corn which cover the fields give a good opportunity for the rain to carry away the soil.

What is about to take place in the case of the Tohickon, seems to have already happened further to the east. Here again the Tinicum is the pirate. A glance at the figure will make plain the state of the case. If the Tinicum is followed

Fig. 2.

down its course to the Delaware it will be seen to make a sharp turn to the north-east just at the point where its pirate tributary comes in from the south-west. Knowing, as we do, that the easier course lies along the strike of the beds and not across it, we naturally turn to this point to see what has taken place. If on coming down the Tinicum to this point we continue to the south, we go for some distance up a small stream flowing north, which comes down to the Tinicum through a deep and rather narrow valley. Continuing our walk along this creek, we soon come to a little sheltered nook, where a picturesque farm-house stands, past which the creek flows, coming in from the south-west. We now leave the latter, and continue up a hollow to the south-east, and across some fields, gently sloping towards a depression in the middle, until we reach another little creek, flowing south into the Tohickon. The explanation of this seems to be as follows: Beaver Creek originally flowed out to the south-east, across the present divide, into the Tohickon, having a similar course to that of the Tohickon in that it crossed the strike of the beds. Tinicum Creek, gnawing along its easier path, reached and captured Beaver Creek, at the point where the sharp turn is seen. The divide which originally stood close to the Tinicum has now been pushed south until it occupies a position close to the letter *B* in the figure.

The beheaded portion of Beaver Creek still occupies the old valley, while an inverted stream now flows north in a directly opposite direction to that of the original Beaver Creek. The old valley across the divide to the Tohickon is seen as the gentle depression in the fields.

This explanation shows us why there is the sudden turn in the Tinicum just at this point. It has worked back on its easy course until it has captured Beaver Creek, and, as shown above, is continuing its work by pushing back towards the Tohickon, which it will very soon capture in the same way.

R. DeC. WARD.

Harvard College, Oct., 1891.

ASTRONOMICAL NOTES.

M. PALMIERI, director of the Vesuvian Observatory, is responsible for the statement that all the great eruptions of Vesuvius take place at new or full moon, and especially eclipses. The eclipse of June 17, 1890, was accompanied by violent earth currents. On the other hand, Captain de Montessus, who has patiently accumulated observations and data concerning earthquakes, has now a catalogue of more than 60,000 of these phenomena, individually discussed. He establishes that earthquakes are distributed uniformly throughout the day and night, that they have no relation to moon culminations and astronomical seasons, and that such coincidences which have been claimed in the past rest on insufficient ground.

M. Janssen, the eminent French astronomer, has been attempting to find solid rock on the top of Mount Blanc, upon which to build an observatory. His scheme has been to bore galleries through the ice, but so far he has been unsuccessful, and he is considering the feasibility of founding an observatory on the ice.

In the December number of *Knowledge* will be found reproductions of photographs, taken by Dr. Max Wolf of Heidelberg, of the region of the Milky Way in the constellation Cygnus, and also in the constellation Sagitarius. Mr. Ranyard, the editor of *Knowledge*, in an article entitled "Dark Structures in the Milky Way," calls attention to several interesting facts connected with the region of the heavens shown in the photographs. One of the regions covered is that surrounding Alpha Cygnus, and directly above that star is seen a dark, branching, tree-like structure. It evidently corresponds to a branching stream of matter which cuts out the light of the nebulous background on which it seems projected, and it is evidently intimately associated with the lines of stars which border the stream and its branches on either side. A somewhat similar dark branching stream may also be traced on a photograph of the region surrounding Epsilon Cygni, a copy of which appears in the October number of the journal above quoted. Altogether the article, with its attendant photographs, is very interesting, and brings to light some new facts connected with that region of the heavens in which the stars seem almost countless.

The small planet discovered by Dr. J. Palisa of Vienna, on Aug. 30 (now numbered 313), has been named Chaldea.

In a very interesting paper in No. 3,066 of the *Astronomische Nachrichten*, Professor Auwers gives the sun's parallax as 8.880″, with a probable error of ± 0.022″ This value is the result of the determination from the German Transit of Venus expeditions in 1874 and 1882, during which years 754 measurements were made. Professor Harkness, in his discussion of the results of the American Transit of Venus Commission, from the photographs alone, obtained the value 8.842″ for the sun's parallax, with a probable error of ± 0.011″. From a discussion of all the data obtainable, he obtained 8.80905″ ± 0.00567″. This latter value corresponds to a mean distance of 92,796,950 miles from the earth to the sun, while Professor Auwers's value corresponds to a distance of 91,814,000 miles.

The following is a continuation of the ephemeris of Winnecke's comet. The epoch is for Berlin midnight.

1892	R.A.			Dec.	
	h.	m.	s.	°	′
Jan. 12	12	28	12	+13	38
13		29	8	13	42
14		30	4	13	47
15		30	58	13	52
16		31	53	13	57
17		32	46	14	3
18		33	39	14	9
19		34	31	14	15
20		35	22	14	22
21	12	36	13	+14	28

The following is a continuation of the ephemeris of Wolf's comet. The epoch is for Berlin midnight.

1892	R.A.			Dec.	
	h.	m.	s.	°	′
Jan. 11	4	16	43	−13	2
12		17	5	12	54
13		17	29	12	45
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15		18	22	12	28
16		18	51	12	19
17		19	21	12	10
18		19	52	12	1
19		20	24	11	52
20		20	58	11	43
21	4	21	33	−11	33

G. A. H.

THE GRADUATE STUDENTS' ASSOCIATION OF JOHNS HOPKINS.

THE *Johns Hopkins University Circular* for November gives the names of graduate students in that university from nearly every State in the Union. Nearly all the Canadian provinces and several foreign countries are represented. These three hundred students are here, primarily for hard work, each in his specialty, in one of fourteen departments. Not a few of the students enrolled last year are now studying in European universities, with the expectation of returning to their work here at the beginning of the next year.

There must be departmental isolation in every university, but this may become extreme. The best training for a capable and cultivated manhood can be obtained only as one mingles with his fellows and shares their varied experiences. An organization which could furnish some tie of social solidarity between students while in residence here, and bring the men into easy communication with universities when abroad, has been lacking. This want, felt by the graduates and some members of the faculty, led to the formation, May 25, 1891, of the Graduate Students' Association. Similar associations have been formed in the universities of Edinburgh, Paris, and in other European universities.

The specific purposes of the association may be gathered from the resolutions passed at the first mass-meeting, from the constitution adopted Oct. 17, and from the reports of the various committees. All of these are freely used in the preparation of the present statement.

Any graduate student may become a member of the association on signing the constitution and paying a small annual fee.

The honorary members consist of the members of the faculty, all past members of the association, and of such distinguished men at home or abroad as may be elected to honorary membership at the yearly meeting of the association.

The functions of the association are comprised in the divisions: international, national, and local or social. The committee on international relations furnish students going abroad with letters of introduction to similar associations in foreign universities, and receive students with letters from like associations of foreign universities. National functions are carried out by a committee who strive to promote intercourse with colleges and universities in the United States and present the advantages of this university to students who contemplate graduate work. This committee has charge of university extension in Baltimore. The social committee receive new students, acquaint them with university methods and give other desired information. They are the medium for co-operation between the faculty and students. They secure any advantages in trade, and adopt such means as may be feasible to promote sociability among the students.

These and other constitutional provisions have been carried out during the present half-year as follows: —

A students' committee, consisting of one from each department, elected by the graduate students of the several departments, was chosen.

The student representatives of the respective departments are: astronomy, Brantz M. Roszel; chemistry, J. E. Gilpin; geology, Francis P. King; biology, R. G. Harrison; physics, George O. Squier; mathematics, E. P. Manning; English, F. J. Mather; history, J. A. James; German, Albert B. Faust; Greek, John H. T. Main; Latin, Sidney G. Stacey; Sanskrit, William W. Baden; romance languages, Julius Blume; Semitic languages, J. D. Prince; pathology, S. Flexner. This general committee, in pursuance of powers granted, elected the association officers and appointed sub-committees for the present year.

The following officers and sub-committees were elected: honorary president, Professor H. B. Adams; president, John H. T. Main; vice-president, W. I. Hull; secretary, R. G. Harrison; treasurer, T. S. Baker; committee on international relations, J. E. Blume, David Kinley, and F. J. Mather; committee on national relations, J. A. James, G. W. Smith, and W. H. Kilpatrick; committee on social relations, R. P. Bigelow, A. B. Faust, S. G. Stacey, U. S. Grant, and J. Blume.

The work accomplished by the committees, although a mere beginning, serves to show that the association has a valuable place in university life. Communication has been entered into with associations of foreign universities. Lectures and courses of lectures have been given by graduate students in the interest of churches and of city associations.

Dr. Walter B. Scaife, a former Hopkins student, by the invitation of Professor Adams, is to give for the benefit of the association an illustrated lecture on "Florence and the Florentines." This lecture is to be given in Levering Hall and followed by an assembly in the parlors. This meeting will be the first of a series of social gatherings to take place during the year.

Through these means it is believed that departmental isolation will be overcome; that men may, through this association, enter into a broader student life, and that the university at large will be convinced of the need for wider social relations than are found in the laboratory or seminary.

JOHNS HOPKINS MARINE LABORATORY.

The following report of the 1891 session of the Marine Zoological Laboratory has just been made to the president of the Johns Hopkins University.

Early in May, 1891, some of the members of our party went to Jamaica, which had been selected as our field of work for the season, while others joined us later on.

Our party was as follows: W. K. Brooks, director; E. A. Andrews, associate in biology; R. P. Bigelow, graduate student in biology; J. P. Campbell, professor of biology, Athens, Georgia; G. W. Field, graduate student in biology; J. C. Gifford, special student in pathology; R. G. Harrison, H. M. Knower, and M. M. Metcalf, graduate students in biology; T. H. Morgan, Adam T. Bruce fellow; G. C. Price, graduate student in biology; John Stuart, teacher of science, Hope School, Jamaica; Charles Taylor, Kingston, Jamaica; B. W. Barton, lecturer in botany; Basil Sollers, teacher, Baltimore. The two last named devoted themselves to botanical exploration and study in the interior of the island, and they did not visit the laboratory at the seashore.

After a preliminary exploration of different seaports, we selected Port Henderson as our station. This is a seaside resort in Kingston Harbor, opposite Port Royal, and about nine miles by water from Kingston. Here we found two partially furnished houses suitable for a laboratory and lodgings, and we rented and occupied them for about fourteen weeks, from May 26 to Sept. 1.

The establishment of a party in a new home at a remote point in a strange country is a task which, in the mid-summer climate of the tropics, is most severe and exhausting. Of this, I was entirely relieved by Dr. Morgan and Mr. Bigelow, who themselves attended to all the preliminary work with great efficiency, and I take this opportunity to thank them for their willing help, which contributed in no small degree to the success of our expedition.

Our summer was devoted, in great part, to the collection and preservation of material for embryological work at home, and, as the members of the party are still employed in preparing and studying it, the results are not yet far enough advanced for reporting. There are a few noteworthy points of interest, however. Among them are the following: —

Soon after we settled at Port Henderson, Mr. Field found near our laboratory, in an enclosed lagoon of dense salt water, a very remarkable rhizostomatous medusa belonging to the genus Cassiopea. No special of this genus, as limited by Haeckel, has heretofore been found anywhere in the Atlantic. It is a South Pacific form, and the known species are from this region or from the Indian Ocean and the Red Sea. A species of a closely related genus, Polyclonia frondosa, was found by L. Agassiz on the coast of Florida, and was referred by him to the genus Cassiopea, although it is not a true Cassiopea. Polyclonia frondosa is found in Jamaica also, and we obtained specimens in Port Royal Harbor. It is also found in the Bahamas, and Professor H. V. Wilson has given to me the notes and drawings which he made from specimens which he obtained at Green Turtle Kay.

The medusa which we found at Port Henderson is not a Polyclonia, but a true Cassiopea, and the only one as yet found in the Atlantic. As it is very abundant and conspicuous, its escape from the notice of naturalists for such a long time is remarkable, for it is so well known to the negro fishermen of Jamaica that they have a name for it — the Guinea corn blubber. As it is one of the most common and characteristic marine animals of these waters, I have proposed to call it, after the Indian name of the island, Cassiopea Xamacha. While it is able to swim slowly by the pulsations of its bell, it is usually found fixed upon the smooth chalky bottom by the flat sucker-like surface of its exumbrella, and in some places the bottom was so completely covered with them that their circular discs were actually touching each other, while the interspaces were filled in by smaller specimens.

Our knowledge of the life history of the rhizostomatous medusæ is very incomplete, and is based entirely upon the study of the Mediterranean *Colytorhiza tuberculata*, a species which belongs to a more specialized division of the group than Cassiopea, although it was formerly called Cassiopea Borbonica. Many fundamental points in the development of the rhizostomes, and, in fact, of the Discomedusæ in general, are still in dispute, and at my suggestion Mr. Bigelow undertook to trace the life history of our Cassiopea, a line of research for which the studies which he has pursued for nearly three years under my direction, on the structure of Discomedusæ, rendered him well qualified. He found the larvæ of Cassiopea on marine plants among the adults, and as these lived in captivity and set free peculiar planula-like buds, which also lived and grew in small aquaria in the house, he was able to obtain a fairly complete series of young stages. The most interesting results of his study of the living larvæ are the discovery of this peculiar method of budding, and the settlement of the question as to the origin and homology of the sense organs of adult Discomedusæ, which he has proved to be the modified basal portions of certain tentacles of the attached larvæ. This is supplementary to, and in amplification of, Mr. Bigelow's former work on the development of the sense organs in other groups of medusæ. While at Port Henderson he watched the larvæ undergo their metamorphosis, and he made drawings from life of the important stages. He is now completing his work by the study of serial sections of the larvæ, and of the organs of the adult. This work, which is now well under way, gives promise of results of very great interest, and I regard it as a very noteworthy piece of work, as it will be, when completed and published with ample illustrations, a permanent and valuable addition to our knowledge of the medusæ.

As I had hoped to find Chiton with eggs, Mr. Metcalf went to Jamaica prepared to study its development. We found several species of Chiton in great abundance on the rocks at Port Henderson, close to our laboratory. Within a few hours after his arrival he obtained the eggs, and soon had a series of larvæ, at all stages of development, living in the house in small aquaria. He devoted the season to the study of the living larvæ, and to the preservation of material for sections. He is now continuing the work at our laboratory in Baltimore, and he has constructed a series of enlarged models from his sections, to exhibit the process of segmentation of the egg of Chiton.

We found ourselves well placed at Port Henderson for studying the Termites, or so-called white ants, and Mr. Knower, who had at my suggestion prepared himself for this work before leaving Baltimore, spent his summer in observing their habits, and in collecting the eggs and larvæ, as well as the adults of the different castes. He preserved a fine collection of these specimens, for embryological and anatomical work, and he is now engaged in the prosecution of this portion of his research

Mr. Field continued at Port Henderson the study of the embryology of Echinoderms, upon which he has been engaged for two years past, and he added to his collection the eggs and larvæ of a number of forms of which he previously had no representation.

Mr. Morgan spent a great deal of his time in gathering and studying material bearing on the problem of metamerization in animals, and in this connection he collected the adults and embryos of Chiton, Ophiurans, etc. He also obtained at several places in the interior of the island a number of eggs from a species of tree frog, which has no tadpole stage, but hatches from the egg as a little frog. Some of these were kept in the laboratory in wet moss until they hatched, while others were preserved at successive embryonic stages. He was so fortunate as to obtain a very complete series of stages, and inasmuch as its development has never been studied, there is every reason to hope that most valuable results will be obtained by the thorough study of this material.

Some ten years ago I found at Beaufort an interesting Crustacean, Lucifer, whose metamorphosis is most remarkable and instructive. I obtained a few eggs, and reared the newly hatched larvæ, and traced the metamorphosis with exhaustive minuteness from the time of hatching to maturity; and my results, with ample illustrations, were presented to the Royal Society of London by Professor Huxley, and were published in the Philosophical Transactions. This work, which was among the first fruits of our marine laboratory, is now embodied in all the standard text-books.

I was not able, at Beaufort, to obtain enough eggs of Lucifer to study the embryology, although the few which I did find showed that this part of its life history is fully as important as the metamorphosis. I have been upon the watch ever since for a chance to obtain a supply of eggs, in order to supplement my first memoir on the metamorphosis by a second on the embryology; but while I have occasionally found Lucifer with eggs, out at sea, I have had no opportunity to study it, as the preparation of the material presents such difficulties that it cannot be carried on at sea. The adult animals are so small that they are almost invisible, and the eggs, which are microscopic, are so loosely attached and so delicate, that they are lost in the act of capturing the adults. I was greatly pleased to find Lucifer in abundance, and by going out in a boat and collecting the adults with great care, and taking them carefully home, I was so fortunate as to find some thirty or forty with eggs, and these I kept in aquaria long enough to obtain a tolerably complete series of stages in the embryonic development. I am now engaged in the study of this material, and I hope to have an account of the embryology of Lucifer completed within a year. My success in obtaining these eggs is an ample return for the expedition to Jamaica.

These are some of the subjects upon which we hope to contribute original scientific knowledge, as the result of our summer in Jamaica; but, be ides its value to science, the expedition had very great educational value to all of us. We saw for ourselves an endless variety of most interesting and instructive natural objects, which we had previously known only from books or preserved specimens, and every hour was filled with most delightful experiences of the greatest value to naturalists and teachers of natural science. I am sure that all the members of our party will be glad to join me in expressing our high appreciation of the great advantage which we have enjoyed in the opportunity to spend a summer in laboratory work at the seaside in Jamaica.

After our return to Baltimore, a series of public lectures, illustrated by specimens and photographs, was given by members of the party, under the auspices of the Naturalists' Field Club of the University.

The lectures were as follows: The Aspects of Nature in Jamaica, by W. K. Brooks; the Zoology of Jamaica, by E A. Andrews; the Natural History of Termites, by H. M Knower; the Botany of Jamaica, by B. W. Barton; and the People of Jamaica, by Basil Sollers.

W. K. BROOKS.

AMONG THE PUBLISHERS.

THE "Browning Cyclopædia," which has been in preparation by Dr. Edward Berdoe, author of "Browning's Message to His Time," will be published very shortly by Macmillan & Co. It is probably the most generally useful of all the aids to the study of Browning as yet attempted.

— Ignatius Donnelly's new book will be entitled "The Cipher in the Plays and on the Tombstone." It is to place the truth of the belief in a cipher beyond controversy.

— Mrs. Laurence Gomme is engaged upon a book of children's games, and also upon a volume dealing with the various local feasten and ceremonial cakes, both of which subjects were rather prominent at the recent Folk-Lore Congress.

— T. Y. Crowell & Co. have just issued the fifth and concluding volume of Sybel's work on "The Founding of the German Empire by William I." The volume contains, besides the text, thirty pages of index and ten pages of chronological data.

— "Homilies of Science" is the title of a volume, by Dr. Paul Carus, from the Open Court Publishing Company, consisting of a collection of short editorial articles discussing religious, moral, and social questions from the standpoint of what might briefly be characterized as the religion of science.

— The office of *The Publishers' Weekly* will publish at once a useful hand-book for the bookseller and librarian, entitled "A Bookseller's Library, and How to Use It," by A. Growoll. The volume contains annotated lists of the principal American, English, German, and French book-trade catalogues, trade and literary journals, leading library and auction catalogues, catalogues of dealers in second-hand books with mention of their specialties, etc. These lists are accompanied by concise and practical hints as to how they may best be used, and the volume thus forms a desirable manual, particularly for the young bookseller.

— The *Atlantic Monthly* for January is a very good number. The article in it that is most likely to attract intelligent readers is that on "John Stuart Mill and the London and Westminster Review." Mill was the proprietor of that *Review* from 1836 to 1840, and had as his assistant in the editorship a young Scotchman named John Robertson; and this article consists in the main of letters that Mill addressed to Robertson during those years. The letters are very interesting, not only as revealing certain aspects of Mill's character, but also as showing the care with which he strove to keep the *Review* up to a high standard, and also with what keen intelligence he criticised the articles that were offered for insertion in it. Another article that is sure to attract notice is that on "Boston," by Ralph Waldo Emerson, in which the author traces the historical connection between the character of the early settlers and the moral and intellectual influence of Boston in American life. He justly says that Boston owes her influence to her religious earnestness and her instinct of freedom, and predicts that, so long as she retains these qualities, her influence will continue. This article was written in 1861, but has never before been published. Mr. Henry James contributes some reminiscences of James Russell Lowell, and expresses the opinion that Lowell's influence was mainly due to his style, both in writing and in speech, — a remark that is to a certain extent true, though the faults of Mr. James's own style are such that he is hardly a competent critic. Besides these papers, there are some excellent book-reviews, the beginning of a novel by F. Marion Crawford, and various other articles which we have not space to particularize. The *Atlantic*'s programme for 1892 is unusually varied and promising; and the magazine is sure to have interested readers throughout the year.

— *Garden and Forest* for Christmas week contained, as its leading illustration, one of a grove of hemlocks whitened with lately-fallen snow, and in an editorial article the stateliness and grace of this northern evergreen are celebrated. There are pictures, too, of a rare orchid in bloom, and cultural directions for growers of fruit and flowers. Mrs. Robbins gives a sketch of Deering's Woods, Portland, in her New England Park series; Mr. Jack adds some notes on his horticultural tour through Europe, and M. Demontzey tells how he has tamed the torrents of the French Alps by reclothing their basins with growing forests.

— From the D. Van Nostrand Company we have received "How to Become an Engineer," by George W. Plympton (18°, 50 cents). It is a brief treatise on the theoretical and practical training necessary in fitting for the duties of the civil engineer, giving the opinions of eminent authorities on the subject, and indicating the courses of study in engineering usually followed in the technical schools. From the same company has come "The Sextant," by F. R. Brainard (18°, 50 cents), being a treatise on reflecting mathematical instruments, with practical hints, suggestions, and "wrinkles" on their errors, adjustments, and use. To the sextant, the form of reflecting instrument most commonly used, most of the little volume is devoted. The volume is mainly a compilation of matter on the subject, well selected and judicially worked into shape; to which the author has added many ideas and suggestions of his own and of officers who have been associated with him in the naval service.

— The *Magazine of American History* opens its twenty-seventh volume with the New Year. The leading paper, by Hon. Arthur Harvey, the president of the Canadian Institute, is the first part of "A Critical and Common-sense View of the Enterprise of Christopher Columbus," illustrated. "The Secret Societies of Princeton University," by Thomas Hotchkiss, Jun., illustrates the old and new Whig Halls at Princeton. "A Short-lived American State," is a contribution from the Louisiana historian, Henry E. Chambers. The question, "Was America Discovered by the Chinese?" is discussed by Rev. Dr. Glover. Those who look for the editor's contribution will find it in an account of "Prince Henry the Navigator," the first to conceive the bold project of opening a road through the unexplored ocean, who indeed was the originator of the impulse which sent Columbus subsequently to our shores. "The Scot in America," by Hon. R. S. Robertson, turns the light upon a most interesting race among the founders of America. "A Sketch of John Badollett, 1758–1837," one of Indiana's strong characters in early times, is by President Bryan of Vincennes University. "Letters on Government Making, by Patrick Henry and John Adams, in 1776;" some things about "Collis P. Huntington," by Hubert Howe Bancroft; "Canada from a European Point of View in 1761;" and other short contributions complete the number.

— One of the early issues of D. C. Heath & Co. will be "White's Number Lessons," graded for second and third year pupils. It has been selected from the everyday blackboard work used in the Syracuse schools. It deals with numbers progressively from ten up into the thousands, using easy fractions and Arabic numerals throughout.

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QUERY.

Can any reader of *Science* cite a case of lightning stroke in which the dissipation of a small conductor (one-sixteenth of an inch in diameter, say,) has failed to protect between two horizontal planes passing through its upper and lower ends respectively? Plenty of cases have been found which show that when the conductor is dissipated the building is not injured to the extent explained (for many of these see volumes of Philosophical Transactions at the time when lightning was attracting the attention of the Royal Society), but not an exception is yet known, although this query has been published far and wide among electricians.

First inserted June 19. No response to date.

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PUBLICATIONS.

A BUSINESS MAN'S HAND-BOOK.

The report of the Postmaster General, just issued, states that nearly $2,000,000 in checks, drafts and money, reached the dead-letter office during the present year through improper addressing—more than one-half from New York State. Probably double this sum has been lost through delays and accidents resulting from carelessuess in mailing and correspondence. To reduce these errors to a minimum, the Government issues THE UNITED STATES OFFICIAL POSTAL GUIDE, in an annual number published in January, and monthly supplements, a book of 900 pages, containing three classified lists of the 66,000 post-offices in the Union. together with postal rules and mail regulations. Every merchant, wholesale dealer, manufacturer and professional man baving correspondence, will find the Guide indispensable. It is also of great assistance in translating illegible writings to lawyers, printers and others. No establishment where accuracy and care are observed as rules is complete without it. The price of the GUIDE in paper is $2.00, in cloth, $2.50. Orders in New York State should be sent to HOME AND COUNTRY, 93 Maiden Lane, New York; outside of New York State to GEO. F. LASHER, 1213 Filbert Street, Philadelphia, Pa. Agents wanted.

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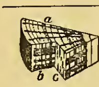

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SCIENCE

NEW YORK, JANUARY 8, 1892.

INFANTS' MOVEMENTS.

In an earlier article,[1] I had occasion to speak of certain phenomena of the infant's muscular development — the phenomena which illustrate the principle of suggestion. A brief survey of certain general characters of these early movements may now be made.

From the outset, movement is the infant's natural response to all influences. And, more than this, Bain and Preyer seem to have made out their case, that from the outset there are movements which are spontaneous, due to unsolicited discharge of the motor centres. At any rate, no observation made after birth can decide the question one way or the other. It remains for the embryologists to continue their work, and this is where Preyer's results get their principal value.

In regard to movements more properly reflex and responsive, I may record a few detached observations on my child. Carefully planned experiments with her, made in the ninth month, showed the native, walking reflex — alternative movement of the legs — very strongly marked. I held her by the body, having made the legs quite free, in a position which allowed the bare feet to rest lightly upon a smooth table. The reflex seemed to come somewhat suddenly, for up to the middle of the eighth month I could not discover more than a single alternation; and this I had determined not to take as evidence, since it could well arise by chance. But, in the ninth month, I observed as many as three and four well regulated alternations in succession. At first most of these movements were the reverse of the natural walking movements, being oftenest such as would carry the child backward. This, however, passed away. I have the following note on June 13, 1890 (the child being one day short of nine months old): "Walking movements, 3 to 4 alternations, backwards oftenest, but tending rapidly to forward movements; later, 2 experiments, each showing 3 to 4 alternations forwards very plainly;" and on June 19: "Fine activity in walking — good alternations, but more backwards than forwards — clearly reflex, from stimulus to the soles." It is easy to see that this backward alternation might be due to some accident of stimulation or discharge when the reflex was first called out; a tendency which early efforts at creeping would soon correct. Yet in H.'s case, it was so marked that for a period she preferred to creep backward.

A few observations were made also upon bilateral reflexes. A gentle touch with finger or feather on the cheek, or beside the nose, or upon the ear, when H. was sleeping quietly upon her back, called out always the hand on the same side. After two or three such irritations, her sleep became troubled and she turned upon the bed, or used both hands to rub the place stimulated. Tickling of the sole of the foot also, besides causing a reaction in the same foot, tended to bring about a movement of the hand on the same side. These observations, not a large number, were made in the sixth, seventh, and eighth months.

A reference has already been made to the late rise of real phenomena of imitation. In support of the assertion, that imitation is rather late in its rise, the following experiences may be reported. As a necessary caution, the rule was made that no single performance should be considered real imitation unless it could be brought out again under similar circumstances. It is probable that cases of imitation recorded as happening as early as the third month are merely coincidences. For example, I recorded an apparent imitation by H., of closing the hand, on May 22 (beginning of the ninth month), but on the following day I wrote, "experiment not confirmed with repeated trials running through four succeeding days." H.'s first clear imitation was (May 24) in knocking a bunch of keys against a vase, as she saw me do it, in order to produce the bell like sound. This she repeated again and again, and imitated it a second time a week later when, from lapse of time, she had forgotten how to use the keys herself. But on the same day (May 24), other efforts to bring out imitation failed signally, i.e., more or less articulate sounds, movements of the lips (Preyer's experiments), and opening and closing of the hands. Ten days later, however, she imitated closing the hand on three different occasions. And yet a week afterward, she imitated movements of the lips and certain sounds, as *pa*, *ma*, etc.[1] From this time forward the phenomenon seemed extended to a very wide range of activities, and began to assume the immense importance which it always comes to have in the life of the young child. It may be noted that H.'s first clear imitation plainly involved a complex voluntary muscular performance; and as far as a single instance is of value, it shows that the will may get control of certain muscular combinations before they are called out to a great extent involuntarily. In this respect, also, my observations confirm Egger's.[2]

In order to test the growth of voluntary control over the muscles of the hand and fingers, I determined to observe the phenomena of H.'s attempts at drawing and writing, for which she showed great fondness as soon as imitation was well fixed. Selecting a few objects well differentiated in outline — animals which she had already learned to recognize and name after a fashion — I drew them one by one on paper and let her imitate the "copy." The results I have in a series of "drawings" of hers, extending from the 7th of last April (the last week of her nineteenth month) to the present (middle of the twenty-seventh month). The results show that, with this child, up to the beginning of the twenty-seventh month there was no connection apparent between a mental picture in consciousness and the movements made by

[1] Science, xvii., 1891, p. 113.

[1] Egger notices this late development of vocal imitation, "L'Intelligence et Langage chez les Enfants," p. 18.

[2] Loc. cit., p. 18-20. Yet I cannot hold with Egger that imitation always involves "intelligence."

the hand and fingers in attempting to draw it. The "drawing" was simply the vaguest and most general imitation of the teacher's movements, not the tracing of a mental picture. And the attempt was no better when a "copy" was made by myself on the paper—a rough outline drawing of a man, etc. There was no semblance of conformity between the child's drawing and the copy. Farther, while she could identify the copy and name the animal, she could not identify her own effort, except so far as she remembered what object she set out to make.

But in the next week (early in the twenty-seventh month) a change came. I drew a rough human figure, naming the parts in succession as they were made: she suddenly seemed to catch the idea of tracing each part, and she now for the first time began to make figures with vertical and horizontal proportion; i.e., she followed the order she saw me take: head (circle), body (ellipse) below, legs (two straight lines) further below, hands (two lines) at the sides of the body. It is all done in the crudest fashion, but that is due to the lack of muscular co-ordination. With the simplification of the figure by breaking it up into parts came also the idea of *tracery imitation*, and its imperfect execution.

As yet, however, it is limited to two or three copies — objects which she sees me make. That it is not now simply imitation of my movements is evident from the fact that she does not imitate my movements: she looks intently upon the figure which I make, not at my movements, and then strives to imitate the figure with movements of her own very different from mine. But she has not generalized the idea away from particular figures, for she can not trace at all an altogether new figure in right lines. Further, she traces these particular figures just as well without written copies before her: *here, therefore, is the rise of the tracery imitation of her own mental picture* — a fact of great theoretical interest.

This illustrates again the point so strangely overlooked by writers on the rise of volition that the earliest voluntary acts are not voluntary movements. The thing pictured and willed here is not a movement, it is a figure — man, bird, dog. This figure suggests (stimulates) its motor associates. It is only later that the muscular movement becomes conscious end.

In the nature of the movements which the child has made in this series of drawings there is a marked change and development. There is growth from angular straight lines to curves, from movements one way exclusively to reverse movements, and an increasing tendency to complex intricate figures, which last probably results from greatly increased ease, variety, and rapidity of movement. At first she made only sweeping "arm-movements," then began to flex the wrist somewhat, and now, with no teaching, she manipulates the pencil with her fingers considerably. This seems to give support to the opinion of professional writing-teachers that the "arm-movement" is most natural and effective for purposes of penmanship.

Further, all her curves are made by movements from left to right going upward and from right to left downward. This is the method of our usual writing as contrasted with "backhand." She also prefers lateral to vertical movements on the paper. Her most frequent and easy "drawing" consists of a series of rapid right-and-left strokes almost parallel to one another. J. Mark Baldwin.

A FEW CHARACTERISTICS OF THE AVIAN BRAIN.[1]

When we compare the brain of a crow or a titmouse with the brain of a snake or a turtle, it is no longer a marvel that birds bear towards their reptilian cousins the relation of intellectual giants to intellectual dwarfs. The cranium of reptiles is small, while the brain-cavity of birds is large, and, what is more pertinent, the whole of that cavity is filled with a compact brain mass. Not only that, but the cerebrum, the seat of the intellectual faculties, constitutes the major portion of that mass.

The cerebrum is composed of two lateral halves or hemispheres, which are so situated that they form a compact heart-shaped mass. The apex of this heart is directed towards the bill of the bird, while the notch is directed towards the tail. These hemispheres are unconvoluted, but the borders of some of the superficial lobes approach almost to the dignity of convolutions. Furthermore, a microscopic study of the brain reveals the fact that occasionally there occurs a blind convolution; i.e., an internal projection of gray matter without a concomitant surface convolution.

A microscopic study of the bird brain does not reveal a cerebral cortex similar to that of the human cerebrum. Here the cerebral cortex is represented by a thin hull containing several loosely aggregated cell-clusters. These cell clusters are constant and are homologous to corresponding clusters in the lizard brain.

Next in size to the cerebrum comes the cerebellum. Not only is it transversely convoluted, not only is it a cover for the medulla, but it is also partly wedged into the notch between the two halves of the cerebrum. This high development of the cerebellum of birds, coupled with the corresponding high development of the cerebellum of fishes, is a strong argument in favor of the hypothesis that the cerebellum functions as a co-ordinating centre for muscular movements.

Neurologically considered, birds are pre-eminently seeing animals, and all parts that appertain to vision are highly developed. The optic nerve is the largest cranial nerve, and the optic lobes are completely differentiated bodies. Even the third, fourth, and sixth cranial nerves, although quite small, are relatively larger than the corresponding nerves of the mammalian brain.

An extraordinary development of one set of organs is never accomplished but at the expense of some other set. In this case the organs of the sense of smell have been the martyrs. Although in the lower avian types the olfactory lobes are paired and conspicuous, yet in the highest types of birds they have been reduced to a small unpaired body which is partly imbedded in the base of the cerebrum.

These two facts lend support to the view that birds of prey find their food more by aid of the sense of sight than by aid of the sense of smell. The birds of prey are far from the lower end of the scale, and in all cases examined the olfactory lobes have been relatively smaller than the corresponding lobes of chickens, geese, turkeys, etc. I have not yet examined a buzzard's brain; but, judging by the figures of A. Bumm,[2] they have small, inconspicuous olfactory lobes.

From the above statements, we see that economy of space is evidenced in all parts of the avian brain. Indeed "progressive compactness" has played so important a part in the evolution of birds that there is a vast difference between the

[1] This is but a brief abstract of a portion of my paper upon the "Morphology of the Avian Brain," Journal of Comparative Neurology, vol. I., pp. 39 9?, 107-134, 265-286, pl V.-VIII., XIV.-XVI., XVIII.

[2] Das Groshirn der Vögel, Zeitschrift f. Wiss. Zoologie, Bd. xxxviii., 1883.

lowest avian brains, with their large projecting olfactory lobes and uncovered optic lobes, and the highest avian brains, with their small, inconspicuous olfactory lobes and covered optic lobes. The difference between these two extremes is almost as great as that between the brain of a lizard and the brain of the lowest type of birds. Yet there is no impassable gulf between these two extremes. All the intervening stages are supplied by the brains of the various avian groups. In reviewing this remarkable sequence, we are almost forced to believe that this tendency towards a progressive compactness of the brain existed long before the first bird was evolved. If this be true, then this tendency towards a progressive compactness of the brain, combined with a tendency to develop all parts appertaining to vision and to atrophy all parts appertaining to smell, will account for all the major differences between the avian and the reptilian brain.

Furthermore, within this class of animals, this "progressive compactness" of the brain is a factor of taxonomic importance. So far at least as major groups are concerned, a classification based upon it alone is, for the most part, in harmony with those classifications that are based upon other structural elements of birds.

Histologically considered, the bird brain is composed of nerve fibres, nerve cells, and neuroglia. Excepting the fornix and hippocampal commissures, all the principal commissures of the mammalian brain, corpus callosum included, are found in the avian brain. Poverty of space causes the omission, in this abstract, of the various other tracts of the bird brain.

Although in the bird brain the nerve cells present a great diversity of forms, yet they may all be grouped in the following classes: ganglionic cells, Deiter's corpuscles, fusiform or flask cells, pyramidal cells, and multipolar cells. The ganglionic cells are large bi-polar cells, which are never found outside of the root ganglia. Each extremity of the cell is prolonged into a nerve fibre. One fibre passes into the brain, the other into a nerve. In addition to the ordinary cell wall, each of these ganglionic cells is surrounded by a special nuclei-bearing sheath. Deiter's corpuscles are small cells, which are supplied with so small an amount of protoplasm that ordinary preparation reveals nothing but their nuclei. These minute cells are universally distributed. In the cerebellum, however, they are densely aggregated in a single lamina; while in the optic lobes they are densely aggregated in several concentric laminæ. The remaining three types are encountered throughout the brain; but in any single nidulus some type always predominates, often to the exclusion of the other two. The flask cells resemble a flask in shape, and when stained each cell presents a faintly stained nucleus, within which is a densely stained nucleolus. Such cells are supposed to function as sensory cells. The pyramidal cells are sub-pyramidal in outline. These cells stain densely, when each one presents a densely stained nucleus, within which is a densely stained nucleolus. Such cells are probably motor in function. The multipolar cells resemble distorted, many-branched, pyramidal cells. Such cells probably act as switch stations for nervous energy.

University of Cincinnati, Dec. 31, 1891. C. H. TURNER.

A NEW SABRE-TOOTHED TIGER FROM THE LOUP FORK TERTIARY OF KANSAS.

IN a collection of Loup Fork Tertiary fossils obtained by the writer from northern Kansas, is a right upper canine of *Machærodus*, apparently different from that of any of the known species of that genus.

The remains of several feline animals have been described from the Loup Fork, one of them (*Felis maxima*, Scott) being the largest of all known *Felidæ;* but none referred to the genus *Machærodus* has been announced. It may, however, yet appear that the *F. maxima* itself, which Professor Scott has but provisionally referred to the genus *Felis*, is a machærodont.

The Loup Fork canine includes the entire root and neck and the basal portion of the crown. As nearly as it is possible to judge, it represents an animal about as large as the puma, but it must be borne in mind that the size of an animal cannot be very positively and closely estimated from a part so highly specialized and so subject to variation in the ratio of its size to that of the body as is the canine in this genus. In any event, the tooth indicates an animal smaller than any of the known American Pleistocene species, unless it be *M. gracilis*, Cope, and considerably larger than the European Miocene *M. palmidens*, de Blainville.

As compared with the larger American species of *Machærodus* (*M. necator*, etc.), *M. gracilis* is characterized by the more compressed form of the basal portion of the upper canine; and this compression is said to be a marked feature. In the Loup Fork species, on the contrary, that tooth has greater relative thickness than in *M. necator*, the thickness of the tooth, at base of crown, being related to its breadth as 1 to 1.65, while the corresponding ratio in *M. necator* (taken from Cope's illustrations) is 1 to 2.2. In *M. neogæus* the ratio, derived from the measurements given by Burmeister, is 1 to 2.33.

The Loup Fork species may be known as *Machærodus crassidens*.

The canine of *M. crassidens* presents a gentle curvature and has its posterior cutting edge compressed and denticulated. Whether the anterior border was of similar character is uncertain. The form of a point-like downward prolongation of the surface of fracture on the anterior border of the crown may have been determined, when the tooth was broken, by the presence of a compressed border, but, if so, the contour of the preserved part of the crown does not indicate it. It is, at least, certain that a denticulate carina did not extend so far from the apex on the anterior as on the posterior border.

DIMENSIONS.

	Inches.
Breadth of crown of canine at base	1.14
Thickness of same	.69
Breadth of crown 1.5 inches above base (about)	.83
Thickness of crown at same (about)	.46
Length of root of canine (to origin of denticulated keel)	2.44
Length of canine, as restored (approximate)	5.45

Should new material prove that only the posterior margin of the canine is denticulated, the species would, in this respect, resemble the *Machærodus nestianus* of the upper Pliocene of Italy. F. W. CRAGIN.

Colorado Springs, Col.

NOTES AND NEWS.

THE Pennsylvania State Board of Health, at the instance of the Governor of Pennsylvania, has issued an invitation to the other State and the more important city boards of health, and to the American Public Health Association, to join in a conference with the officers of the World's Columbian Exposition at the city of Chicago, with the view to making an exhibit of the objects, methods, and results of the work of sanitary officials in this country.

— Mr. Charles S. Peirce has tendered his resignation as Assistant in the United States Coast and Geodetic Survey, to take effect Dec. 31. Mr. Peirce was first attached to the Survery about thirty years ago. During the greater part of the time he has had charge of its operations relating to the determination of the force of gravity. Some of the results of his investigations have been published as appendices to the Annual Reports and have embodied contributions of great importance to science. It is understood that Mr. Peirce will continue to furnish the Survey from time to time special discussions of topics related to the subject to which he has devoted so many years.

— The routes, both northern and southern, now formally adopted by the principal transatlantic steamship companies are shown on this month's Pilot Chart issued by the United States Hydrographic Office. The northern routes remain in force until the middle of January, but steamers that take their departures from Sandy Hook Light-vessel, Boston Outer Light, Fastnet, or Bishop's Rock, on or after the 15th, follow the southern routes, which then remain in force till the middle of July next. As stated last month, on the chart, five steamship companies (the Cunard, White Star, Inman, Guion, and National) have adopted these routes to and from the Fastnet, and the following companies have now come into the agreement (taking the great circle between Bishop's Rock and the Banks): North German Lloyd, Hamburg-American, Companie Génerale Transatlantique, and Red Star. It will be remembered that the Pilot Chart recommended that the Channel steamers adopt the same routes (west of the 20th meridian) as the Queenstown steamers, but these companies have decided to follow the great circle direct to the Grand Banks. The objection to this course is that the region within which eastward and westward bound vessels are liable to encounter one another is broader than in case the point of junction is shifted farther east, say to the 20th meridian, while the distance saved is comparatively slight (only six miles for the northern and nine miles for the southern routes). Possibly at some future time a compromise will be made by which the junction will be fixed at some point that may be mutually agreed upon (say about the 15th meridian in latitude 51° north). Until such an arrangement is made by the companies interested, the routes already adopted and actually in force will be shown on this Chart.

— A correspondent of the London *Spectator*, writes os follows: I have studied the habits of the scorpion for many years, and have often noticed how very sensitive scorpions are to the most delicate sound, musical or otherwise. Under the thorax the scorpion has two comb-like appendages, which are the antennæ (pectinatæ). It is pretty well settled by physiologists and entomologists that in insects the antennæ represent the organs of hearing. These delicate structures are easily affected by the vibrations of sound, and there can be no doubt whatever that they are also affected by sounds quite inaudible to the human ear. The slightest vibration of the atmosphere, from any cause whatever, at once puts in motion the delicate structures which compose the antennæ, to which organs insects owe the power of protecting themselves against danger, as well as the means of recognizing the approach of one another. Spiders have wonderful eyesight, but I am quite sure that the scorpion's vision, notwithstanding his six eyes, is far from being acute. It is very difficult to catch a spider with a pair of forceps, but a scorpion can be easily captured, if no noise is made. Spiders see their prey before they are caught in the web; but the scorpion makes no movement whatever to seize flies or cockroaches until they indicate their whereabouts by movements. This being the case, it can readily be understood how easily the scorpion may be roused into motion by the vibrations of music, as described in the article alluded to. If a tuning-fork be sounded on the table on which I keep my caged scorpion, he at once becomes agitated, and strikes out viciously with his sting. On touching him with the vibrating tuning-fork, he stings it, and then coils himself up, as scorpions do when hedged in. In Jamaica, the negroes believe that scorpions know their name; so they never call out, "See, a scorpion," when they meet with one on the ground or wall, for fear of his escaping. They thus indirectly recognize the scorpion's delicate appreciation of sound; but if you wish to stop a scorpion in his flight, blow air on him from the mouth, and he at once coils himself up. I have repeatedly done this; but with a spider it has a contrary effect. Music charms a snake into silence, as the experiments at the Zoo and elsewhere prove; but the agitated contortions and writhings of the scorpions when roused by the sound of the violin only prove that they are roused by the vibrations of sound caused by music, and this would happen if they were disturbed by the discordant sounds of a penny trumpet or any other unmusical instrument.

— At the recent French Surgical Congress MM. Henocque and Bazy reported the results of a series of examinations of the blood with the spectroscope made on persons who were compelled to undergo surgical operations. According to these investigations the demonstration of the quantity of hæmoglobin in the blood affords the surgeon some valuable information in cases where it is necessary to decide whether the patient's health is sufficiently good to permit of the performance of an operation which may not be urgently required. In ovariotomies and laparotomies undertaken for the removal of tumors it is of advantage to determine the degree of anæmia and the condition of nutrition by this method, so that the operator may be able to select the most favorable time for operation. The authors also made, according to the *International Journal of Surgery*, some exceedingly interesting experiments with the view of studying the effects of chloroform anæthesia upon the quantity of oxy-hæmoglobin in the blood and upon tissue metamorphosis. These investigations were carried on before, during, and after the performance of surgical operations. It was demonstrated in eight cases of major operations that chloroform actually tends to augment the quantity of hæmoglobin in the blood, unless a condition of asphyxia is produced, and that this quantity may remain stationary despite severe losses of blood. One of the constant effects of chloroform anæsthesia, however, is to retard the reduction of oxy-hæmoglobin; that is to say, it decreases tissue metamorphosis. These phenomena therefore illustrate that chloroform does not exert a toxic influence on the blood, although it has a marked effect in retarding the vital chemical processes in the body. In cases of sudden death at the commencement of chloroform anæsthesia a complete arrest of tissue metamorphosis takes place, and to this, in the authors' opinions, should be attributed the extraordinary severity of this form of syncope. They also believe that these facts demonstrate the advantage of determining before operation whether an individual tendency to retarded tissue metamorphosis be present. In striking contrast to the results obtained by MM. Bazy and Henocque, however, Dr. Mikulicz found that the prolonged administration of chloroform produced a decrease of hæmoglobin even in operations unattended with loss of blood. This fact simply illustrates the wide discrepancy in the results obtained by different investigators of the same subject.

— In a bulletin just published by the Entomological Division of the Cornell University Experiment Station, Professors J. H. Comstock and M. V. Singerland report upon a series of experiments, continued for three years, the object of which was to discover a practical method of preventing the ravages of wireworms. Some of the results of these experiments are summarized as follows: Grains of corn were coated with a flour paste containing Paris green and planted. The only apparent result was to retard the sprouting of the seeds, the wireworms apparently thriving upon the poisoned paste. The rose bug is another insect which it is practically impossible to kill with Paris green. Coating the seed corn with tar or soaking in salt brine, copperas solution, kerosene oil, or turpentine interfered with germination much more than it did with the appetite of the wireworm. Soaking in strong solution of strychnine failed to render the corn either distasteful or destructive to the worms. Starvation was found to be as ineffectual as feeding on poison, as the soil was kept entirely bare of vegetation for an entire season without reducing the number of worms. Buckwheat, Chinese mustard and rape have been recommended as crops upon which wireworms will not feed, but in these experiments the worms lived and thrived as well upon the roots of these plants as they did upon those of timothy and clover. Kerosene oil, crude petroleum and bisulphide of carbon were applied to the soil as insecticides, the kerosene and petroleum being also used in the form of emulsions. They killed the wireworms when applied in sufficient quantity to destroy all vegetation also.

Their use was found impracticable on account of the cost. Many farmers believe that salt either kills wireworms or drives them deeper into the soil beyond the roots of crops, and a series of carefully planned experiments were made to test this theory. The results showed that in order to destroy wireworms salt must be used at the rate of about eight tons to the acre, or over one per cent of the soil to a depth of four inches must be salt. Half a ton of salt to the acre was found sufficient to prevent one-half the wheat from germinating, and four tons per acre, applied in July, killed all the grass in a few days. In soil salted at the rate of 1,000 pounds per acre the worms were found, after some months, as numerous and as near the surface as in unsalted soil. Kainit, a German potash salt now used extensively as a feltilizer, has been supposed to be useful in exterminating wireworms, and the syndicate which is pushing the sale of Kainit in this country make great claims on this score ; but in the Cornell experiments four to nine tons of Kainit per acre produced but little if any effect upon the wireworms in the soil. Other potash salts gave no better results. Lime, applied at the rate of 200 bushels per acre, had no effect upon the wireworms. Chloride of lime, used at the rate of nearly six tons per acre (costing about one hundred dollars per ton), was found to be quite effective. Gas lime, applied fresh and at the rate of twenty to forty tons per acre, proved partially effective. Trapping by baits produced the only results that gave any encouragement, but these baits caught, not the wireworms, but its parent, the click-beetle. The most satisfactory trap was a wad of fresh clover, dipped in Paris green water and placed under a board. These experiments were made in cages in such manner that the conditions could be absolutely controlled and the results accurately determined. Their negative results may be of great value to farmers by preventing the waste of time and money in trying useless methods of prevention. The only hope of a practicable remedy the investigators hold out to the farmers is that by fall plowing the worms may be disturbed at a critical period of their existence, when disturbance means death. They recommend plowing as soon as possible after wheat harvest, pulverizing immediately and thoroughly with the harrow, and seeding with wheat or rye in September, followed by not more than one or two crops of grass or clover, this to be plowed under in the summer as before. It will take several years of this method of short rotations to exterminate the worms, as they live for three years in the worm stage, and can only be injured by plowing at a certain period, but farmers who practise this method have little or no trouble from wireworms.

— At the recent annual meeting of the American Folk-Lore Society, in Washington, D. C., Rev. J. Owen Dorsey read a paper, entitled, "Nanibozhu in Siouan Mythology." At the previous annual meeting of the Society (in New York), a paper was read by Professor A. F. Chamberlain of Clark University, on "Nanibozhu among the Otchipwe, Mississagas, and other Algonkian Tribes." (*Journal American Folk-Lore*, for July–September, 1891, pp. 193–213). Mr. Dorsey's paper was designed to show the points of agreement and difference (so far as Nanibozhu is concerned) in the mythologies of the two linguistic stocks of families, the Algonkian and the Siouan. In the preparation of Mr. Dorsey's paper, the author consulted the myths of the Omahas, Ponkas, Kansas or Kaws, Osages, Iowas and Otos, all of which were collected by himself for the Bureau of Ethnology, and the Dakota myths of the late missionary, S. R. Riggs, and those in the Bushotter collection, these last consisting of two hundred and fifty-seven texts written by an Indian in the Teton dialect of the Dakota language. In Algonkian mythology, Nanibozhu, Manabush, or the Great Hare (sometimes called the Manito of winter), is a single character, easily identifiable. But in Siouan mythology we find several characters, each one of whom resembles the Algonkian Nanibozhu in one or more respects. The principal characters thus known to the Omahas and Ponkas are the following : 1. The Rabbit, the great friend of the Indian race (answering to the Badger in Dakota mythology). 2. I shti-ni-ke, the enemy of the Rabbit, the great Deceiver, a malevolent being. His Dakota counterpart, I-kto or I kto-mi in Teton, and Un-kto mi in Santee Dakota, is often a clown, a "jolly good fellow" deceived by the Rabbit, malevolent on some occasions. The Omahas call I-shti-ni-ke the "Black Man," and they and the Ponkas now apply his name to any species of ape or monkey. The Dakotas give the name of Ikto or Unktomi to the spider. 3. Ha-ghi-ge, a very cunning person, who wounds two water gods in order to avenge the death of his little brother, meets I-shti-ni-ke, when the latter is disguised as He-ga, the Buzzard, learns his secret power, and then kills him; kills the water gods whom he had wounded; is chased by the other deities, but escapes by becoming a large rock; restores his brother to life for a season; and has other adventures. The other characters who resemble Nanibozhu are as follows: In Dakota myths, the Badger figures instead of the Rabbit, and the Blood-Clots Boy takes the place of the Rabbit's son, the orphan and Wears-a-plume-in-his-hair. In the myths of the Omahas it is the orphan who kills I-shti-ni-ke, but the Ponkas refer that act to the Rabbit's son. Wears a-plume in-his-hair was the conqueror of the "Bad Men," magicians, three of whom he killed; he sought the survivor, but did not recognize him in his disguise as a beautiful woman. The woman induced the hero to rest his head in her lap, and while he slept she changed him into a mangy dog, and took the hero's shape. In the course of time, the hero was restored to his own shape. He changed the bad man into a dog, and then killed him. The Omaha and Ponka myths referred to in this paper are given in full in their respective originals (with free and interlinear translations) in "Contributions to N. A. Ethnology," Vol. 6, which has just been published. The paper on Nanibozhu will probably appear in a future number of the *Journal of American Folk-Lore.*

— In a recent number of *The Illustrated American* is an illustrated article on the Museum of Natural History at South Kensington, which was first thrown open to the public on Easter Monday, 1881. Some years ago the British Museum had become so overstocked in certain departments that it was deemed necessary to erect another structure, to contain all objects connected with natural history, and Parliament voted three hundred and ninety-five thousand pounds (nearly two million dollars) for the purpose. Alfred Waterhouse was the architect chosen to carry out the work. The architecture may be termed Decorated Norman, and in some respects it is unique. The whole edifice is cased with terra cotta, and the doorways and windows are ornamented with columns designed from objects of natural history—two features that have provoked much criticism. It has been charged, says *The Illustrated American*, that the tint of the terra cotta is not suitable for making the various articles in the museum stand out in relief; that it was a mistake to bring in close proximity the real objects of natural history and the conventional representation of them adopted by architects; and that the crowding together on the same column or moulding representations on one scale, of microscopic and gigantic organisms, inhabitants of sea and land, was unwarrantable in a building designed for educational purposes. Complaint has also been made that the great hall is semi-ecclesiastical in style. The south front of the building is six hundred and seventy-five feet long. There are three stories, in addition to the basement. The central hall is one hundred and fifty feet long, ninety-five feet wide and sixty feet high. Along its two sides are twelve arched recesses. The floor is inlaid with mosaics of Italian marble. At the north end of the hall is a wide handsome staircase, which branches off, right and left, to the open corridors or side aisles on either hand upon the first floor. Where the stairs branch a superb marble statue of Darwin has been placed. The lofty ceiling is admirably decorated, and is very effective. Along its central line there is a double row of panels, in groups of six, following the curve of the vault. On these are representations, in relief, of many species of trees, shrubs and flowering plants. Each tree decorating the central part of the ceiling occupies six panels. The height of the building makes this bold treatment absolutely necessary. But over the staircase and landing leading to the second floor the ceiling is less distant from the eye; therefore a tree is represented in each panel, and many fine details have been carefully worked out, details that were purposely omitted in the central part, as they would have been lost in the distance. One unpleasing effect of the loftiness of the arched roof is that it dwarfs the cases placed around the room.

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THE KLAMATH NATION.[1]

II.—LINGUISTICS.

WHEN, early in the present century, the American languages, or rather a certain number of them, and particularly those of the Algonkian, Iroquoian, Mexican, Peruvian, and Araucanian families, became the subjects of scientific study, the first emotions which this study excited were those of surprise and pleasure. The elaborate forms, the many ingenious methods of word-composition, and the singular capacity for expression thence derived, filled the first inquirers with admiration. This admiration, expressed with the enthusiasm of discoverers, naturally awakened scepticism and adverse criticism. The criticism, originating mainly in prejudice and the pride of race, and based on that partial knowledge which is sometimes more misleading than ignorance, was for the most part unfounded and unjust. The critics objected that the American languages, being those of barbarous tribes, must necessarily be inferior to the idioms of highly civilized races, like the Aryan and Semitic nations; but they forgot that the early Aryans and Semites were themselves barbarians, and yet their languages, as we know from many facts, were as well constructed and as expressive in their era of barbarism as in that of their highest culture. The objectors also informed us that the reason why the words of the American languages were of such elaborate formation and often excessive length, was simply because the speakers, being barbarians, had not attained the analyzing power required to reduce the vocables to their component parts; but further investigations have shown that many American languages, including the Dakota, the Maya, and the Othomi tongues, are in some respects even more analytic than the Aryan, and their words generally briefer. We were further told that the American idioms had not the substantive verb, which, we were assured, was the highest expression of Aryan and Semitic analysis and abstraction. But later researches have found this verb in the Athapascan, the Sahaptin, the Klamath, and various other Indian tongues, as fully developed as in the Sanscrit or the Greek. Then we were assured that American languages had few or no expressions for abstract ideas. We now find that some of them abound in such expressions, and have peculiar forms especially designed to indicate them. The objectors derided certain Indian languages, like the Iroquoian and the Algonkian, in which the terms of kindred must always have a possessive pronoun attached to them. How poor, they argued, must be the speech of a people who cannot say simply "father" and "son," but must always employ the composite forms, "my father," "his son," and the like. We now know that languages of this type are not universal, and that in idioms spoken by tribes lower in culture than the Algonkians and the Iroquois, the possessive pronouns are independent words, and are never attached to the nouns. Finally, these critics, all of Aryan or Semitic origin, proudly assure us that the noble races to which they belong are the only peoples whose languages are really inflected. All other idioms belong to a lower type, the "agglutinative." Their so-called inflections are simply bits of significant words, affixed to the roots, and still retaining indications of their origin. Duponceau, the first and greatest of American philologists, has long ago shown, by the evidence of the Delaware grammar, the error of this assumption; and we now have to see how completely this and most of the other objections of the worshippers of the Aryo-Semitic fetish are disproved by the results of Mr. Gatschet's careful and thorough studies.

Pure inflection, properly speaking, — that is, inflection of non-agglutinative origin, — is a change made in the substantial or radical part of a word to indicate a difference of meaning, as when the Hebrew changes the ground form of *lamar*, to learn (or "he learned"), to *lemor*, to express the imperative mood, or as when the Ojibway, to form the participle, changes *nimi*, he dances, to *namid*, dancing. In the primitive Aryan languages the most important change of this description is the reduplicative form, which in the Sanscrit, Greek, and Gothic, and occasionally in the Latin and other tongues, is used to give a preterite signification. This form of inflection occurs, with varying purport, in many American and Oceanic languages. Most generally it indicates plurality, as in the Mexican and Sahaptin idioms; but frequently it expresses (as in the Japanese and the Dakota) iteration, distribution, or other allied meanings. In the Klamath it assumes a wide development, pervading the whole language, and modifying almost all the parts of speech, from nouns and verbs even to many of the particles. Its principal functions, according to Mr. Gatschet, are iterative and distributive. But the various modifications of meaning produced by redoubling the first syllable or the first two syllables of a word, with many euphonic changes, give nice distinctions, which enrich the language to a remarkable extent. Thus from *lama*, to be dizzy, we have *lemlēma*, to reel or stagger; from *palah* or *pelah*, quickly, *pelpēla*, to work, to busy oneself at; from *tuēka*, to pierce, *tuektuēka*, to stare at, i.e., to pierce with the eyes; from *wita*, to blow (as the wind), *witwita*, to shake or struggle; from *mukash*, fine feathers or down of birds, *mukmukli*, downy, soft. The verb *lutatka*, to interpret, makes its frequentative mood by an abridged reduplication, *lultatka*, to interpret frequently, and hence we have the noun *lultatkuish*, a professional interpreter. So from *shiukish*, one who fights, a derivative of the verb *shiuka*, to fight, we have, by a twofold reduplication, *shishókish*, a warrior, and *shish'shokish*, a hero, one who has fought in many battles; and, in like manner, from *tamnuish*, one who is travelling (a derivative from *támenu*, to travel), we have *tatamnuish*, one who travels habitually, a stroller

[1] The first article — on the "Klamath Country and People" — appeared in the last number of Science. The third and concluding article — on "Klamath Mythology and General Ethnology" — will appear in the next issue.

or tramp; from *latcha*, to build, we have, in the frequentative or usitative form, *laltshish*, an architect; from *tedsha*, to wash, *tetádshish*, laundress. Almost endless examples might be given, showing the wealth of varied expressions which the language derives from this form of inflection.

Of the more ordinary class of inflections, derivational and grammatical, produced, like most of those in the Aryan tongues, by the agglutinative process, the Klamath has a vast number. Mr. Gatschet gives a list of formative affixes, filling more than a hundred quarto pages, and rivalling in extent and variety the list comprised in the second volume of Brugmann's "Comparative Grammar of the Indo Germanic Languages." The prefixes exceed fifty, and the suffixes two hundred. These affixes have sometimes internal euphonic inflections. The prefix *hash*, or *hesh*, for example, which forms causative, reciprocal, and reflective verbs, varies its vowel in a certain correspondence or euphonic correlation (though not always agreement) with the varying vowel of its radical. From *pan*, to eat, we have *háshpa*, to feed or cause to eat; from *uámpeli*, to recover, *heshuámpeli*, to restore to health; from *púnua*, to drink, *hushpanua*, to give to drink. *A* is a common suffix, which forms verbs from nouns, adjectives, and particles; *ka* is a "factitive" suffix, forming causative and transitive verbs; *ank* is the suffix which forms the present participle, like the Latin *ans* and *ens*, and the English *ing*. An example will show the fine shades of meaning in the derivatives formed by these suffixes. *Hewa* or *shewa*, to suppose, believe, think, coalesces with the reflexive prefix *hush* to form a new verb *husha*, to remember. The factitive affix *ka*, added to *husha*, produces *hushka*, to think about a thing, to study. The active participle of *hushka* is *hushkank*, thinking, studying. Adding to this the verb-forming particle *a*, we obtain the derivative verb *hushkanka*, to be reflecting or considering, to be in a certain mood or state of mind about anything. These word-forming particles yield an enormous addition to the Klamath vocabulary.

The declensions of nouns and adjectives resemble those of the Aryan languages, but are more extensive and more logically exact. There are fourteen cases, comprising, besides those of the Sanscrit, Greek, and Latin, several locative cases, and a temporal case. The latter ends in *emi* or *ăm*, and signifies "during" or "at the time of;" as from *skō*, spring, we have *skoémi*, during springtime; from *kish*, sunset, *kishémi* or (contracted) *kissăm*, at sunset. The accusative (or objective) case of "inanimate" nouns — corresponding to the Latin neuter — has (as in Latin) the same form as the nominative; but that of animate nouns ends in *ash*, or sometimes simply in *sh* or *a*. Thus *laki*, chief or head-man, has in the accusative *lakiash ; muni*, great, has *muyánash*. The adjective agrees with its noun in case and number, though with some variations in the forms; thus from *muni laki*, great chief, we have in the genitive (or possessive) case *muyánam lakiam*, of the great chief; in the accusative, *muyánash* (or *munish*) *lakiash ;* in the instrumental case, *muyántka lákitka*, by means of the great chief; in the directive case, *muyán'sh* (or *munish*) *lakiashtala*, toward the great chief, etc. The distributive form, which answers for the plural, has, in the nominative, *múmeni laláki*, each great chief; in the accusative, *mumián'sh* (or *múmenish*) *laláki̇ash;* in the possessive, *mumiánam lalákiam*, of each great chief; and so on, through the various cases.

Space fails for describing the conjugations of the verb, except to mention the two participles, so curiously resembling the Aryan forms, namely, the present (or indefinite), ending usually in *ank* or *an*, and the preterite, ending in *tko* or *tk*; as from *koka*, to bite, *kokank* or *kokan*, biting, and *kokatko*, bitten. The substantive verb *gi* or *ki* (pronounced *ghee* or *kee*) has for its present participle *gian or giank*, being, and for its preterite *gitko*, been. As an auxiliary verb it is used, in its various inflections, with the past participle of other verbs to form the passive voice, as in *kokátko gi*, to be bitten; *kokátko giuapk*, will be bitten; *kokátko gít*, may be bitten; *kokátko giuga*, in order to be bitten. This substantive verb has a signification as abstract as the same verb in any Aryan or Semitic language, with often a wider compass of meaning, answering to both *ser* and *estar* in Spanish.

The pronouns, personal and possessive, are never combined with either the noun or the verb. What some grammarians have styled the transitions, and others the composite or objective conjugations, are therefore unknown to the Klamath, which in this respect is as analytic as the English or German, and far more analytic than either Greek or Hebrew.

Mr. Gatschet, after describing the great variety of structure in the American languages, varying from the extremely synthetic to the markedly analytic, observes that the Klamath "occupies a middle position" between these extremes, "but that, nevertheless, it shows very plainly all the characteristics of agglutinative tongues." He should have added — as his own minute and careful descriptions clearly show — "but not more plainly than these characteristics are displayed by the Sanscrit or the Greek." Liberal and philosophical as he is, he has not yet succeeded in entirely emancipating his mind from the influences of the Aryo-Semitic superstition, which is now in comparative philology what the geocentric superstition, before the time of Copernicus, was in astronomy. But he proceeds, in terms as accurate as they are elegant and forcible: "These and other characteristics impart to the language of the Maklaks a well-defined type, and approach it to the tongues of modern Europe, in which analysis has not preponderated over synthesis. An attentive study of the numerous texts obtained from the Indians [of which, it should be added, Mr. Gatschet's work furnishes an ample and most interesting collection] paired with constant comparison of Klamath structure with the structure of many foreign and American languages, could alone furnish a solid basis for establishing the grammatical rules of this upland tongue. The rhythmic, stately, and energetic tenor of its periods, especially those of the larger mythologic pieces, will please every student who has ever lent his attentive ear to the well-poised periods of Roman historians, and will even evoke comparison with them, not as to their contents, but as to the plan of the well-constructed sentences which appear in these narratives."

HORATIO HALE.
Clinton, Ontario, Canada.

IOWA ACADEMY OF SCIENCES.

As announced, the sixth annual session of the Iowa Academy of Sciences was held in DesMoines, on the 29th and 30th of December. Interest and enthusiasm were manifested throughout the session. Heretofore the annual meetings have been held in September, an unfortunate time for most of the scientific workers of the State. The following programme was carried out.

Professor C. C. Nutting, the president, delivered an address on "Systematic Zoology in Colleges." He urged the importance of systematic zoology in colleges. He thought it unfortunate that the German craze for morphology should occupy so much attention in colleges to the exclusion of very important systematic work. He would not, however, belittle the work of the morphologist, since the whole structure of the systematic zoologist rests largely on the results of his labors. One reason why systematic work has failed to command the attention that it deserves on the part of the college student is a wide misapprehension as to its real nature and scope. A majority of students are wont to regard systematic zoology as particularly to be shunned on account of what they consider its most essential character — an endless succession of fearful names, a veritable nightmare of polysyllabic horrors, the dead languages resurrected for the special discomfort of the unfortunate student. Systematic zoology is much more than a collection of names. Classifications are but the skeletons which his studies and investigations should clothe with living facts, so that finally the dry bones will be almost forgotten as he contemplates the beauty and symmetry of the well rounded vital structure.

Professor F. M. Witter read two papers on "Arrow Points from the Loess" and "The Gas Wells near Letts, Iowa." The hills on which the city of Muscatine stands are covered with a very fine deposit of loess, which in some places must be nearly fifty feet thick. This loess abounds in land shells, the bones of at least two American reindeer, a considerable part of the antler of the elk or common deer. The ancient loess lake is nearly 150 feet above the present high-water of the Mississippi. In this loess deposit has been found an arrow point and a spear point. In it also occur fragments of the tooth of an elephant. Professor Calvin, in discussing this paper, remarked that arrow points had been found in the loess at Council Bluffs some years ago. He also referred to a skull found in Iowa that resembled the famous Neanderthal skull. That man was undoubtedly contemporaneous with the elephant shortly after the great ice age.

In speaking of the gas wells of Letts, Iowa, which have been flowing since December, 1890, Professor Witter thought it due to the decomposition of organic matter in the lower part of the drift material. Professors Call and Calvin both remarked that the flow of gas would not be permanent; it was wholly unlike the gas of Ohio and Indiana. Chemical examination has shown that this gas is closely related to marsh gas.

Professor Haworth read papers on "Melanite from Missouri," and "Prismatic Sandstone from Madison County, Missouri" (read with consent of the state geolcgist). He also presented a paper on "Limonite Pseudo-morphous after Calcite."

Professor J. E. Todd read a paper on "Striation of Rocks by River Ice." Specimens were exhibited showing striæ. These were observed at St. Louis, Cape Giradeau, Mo., and Sioux Falls, So. Dakota, also at several points along the Missouri. He also presented, by title, a paper on "Further Notes on the Great Central Plains of the Mississippi."

Professor Calvin gave an account, showing specimens, of the distinctions between *Acervularia davidsonii* and *A. profunda*. The species are quite distinct, not only does this difference appear in the external characters, but when they are polished. Both species occur in Iowa, sometimes in the same geological formation.

Professor Call spoke of "The Present Status of Artesian Well Investigation in Iowa." This work has been done in connection with the Iowa State Weather and Crop Service. The artesian wells are very numerous and extensive. Many of the so-called artesian wells are not artesian wells in the sense that Professor Call uses the term. As an instance, he cited the wells at Dunlap and Council Bluffs, which are not artesian, since water does not flow under hydrostatic pressure. Professor Todd took issue with him on this point. The wells at those places are on high elevated portions of the country. If they had been bored on lower ground, a short distance away, they would produce flowing water.

Mr. Charles R. Keyes presented three geological papers as follows: "Geological Structure and Relations of the Coal Bearing Strata of Central Iowa," "Brick and Other Clays of DesMoines," and "Aluminium in Iowa." The clay used at Hampton, Iowa, where a large stock company has recently been organized, is said to be the richest in the country, yielding eight ounces per bushel, or three ounces more than is produced in any known deposit of the neighboring States. Aluminium is soon to take the place of iron to a large extent in the arts, and the value of the early development of the industry cannot be overestimated. In speaking of the brick and other clays of DesMoines, he said that perhaps no province in the Union is better supplied with raw material of unexcelled quality for the manufacture of those objects commonly made from clay than our own State.

The only chemical papers were those presented by Professor G. E. Patrick. One was on "Sugar Beets in Iowa." Something over 500 samples from more than half the counties of the State have been analyzed. The results are highly gratifying. Though the sugar content on an average is less than in Nebraska, the yield is considerably more. More sugar can be grown on an acre in Iowa than in Nebraska. It was also shown that beets on the station farm, although under the best of culture, contained less sugar than those of Muscatine, which is owing to soil conditions. Certain portions of this State are apparently well adapted to the growing of beets for sugar production, and he mentioned the fact that of the 500 samples of beets recently analyzed at the Experiment Station, sent in from all parts of the State, the best have come — and in large numbers — from the regions about Davenport and Muscatine. He added, however, that "there may be other parts of the State just as well adapted to the beet-sugar industry as the localities here named." Professor Patrick's other paper was on the subject, "Can Fat be Fed into Milk, i.e., Can the Composition of Milk be Modified by Variations in the Kind of Food?" As opposed to the writings of several other scientists who deny food influence upon the composition of milk, he cited a number of European and American experiments,— one of which was recently performed at the experiment station at Ames,— which seem to prove conclusively that the kind of food fed to cows does have a material influence upon the percentage of butter-fat in the milk.

Professor S. E. Meek presented a paper "On the Fish Fauna of Arkansas and Iowa Compared." The river basins of eastern Iowa contain many more species than the river basins of the western part of the State. About 120 species occur in the State. Arkansas, which has not been thoroughly explored, contains 150; the darters being more numerous in Arkansas than in Iowa.

Professor R. E. Call exhibited a specimen of "An Abnormal Hyoid Bone in the Human Subject."

Professor H. L. Bruner, in a paper on "An Aboriginal Rock Mortar," referred to relics found on the east slope of the Franklin Mountains, about eleven miles north of El Paso, Texas, and near the mouth of the "Hous Cañon."

Professor Tilton found near Indianola, Iowa, a three-legged snow-bird, which was exhibited. In domestic animals this is not an uncommon occurence, though it is rather rare in wild animals

Four entomological papers were read. Professor Herbert Osborn presented two, on "The Orthopterous Fauna of Iowa" and "Notes on Certain Iowa Diptera." Sixty-seven species were enumerated. The notes were based on specimens found almost entirely in the central part of the State. The Orthoptera are among the most important of the injurious insects of this State, almost all the species being destructive, and scarcely one that can be considered as of any benefit. A Texas species, *Arphia conspersa*, was reported from Ames; *Periplaneta orientalis*, apparently confined to larger cities; and *Platamodes pennsylvanica*, very common in doors and out. Professor Osborn and H. A. Gossard presented some "Notes on the Life History of Agallia sanguinolenta." This leaf-hopper, though a clover pest, also feeds on beets, rutabagas, cabbages, and blue grass. It is active even in midwinter, on sunshiny days. The first brood of larvæ appear between early May and July 1. The earliest individuals of the brood are nearly matured by the first of July. Larvæ can be found, in all stages, from this time until the advent of winter. Most of the individuals are believed to be included in two broods.

Professor C. P. Gillette, in a paper on "How the Female of Cacœcia semiferana Protects Her Egg-Clusters," stated that one of the most novel methods is that employed by the box-elder leaf-roller. The egg patches are covered over with a gluey material, and this is nearly always completely covered with a dense mass of scales placed like shingles on a roof. These scales closely resemble those found on the under side of the abdomen.

Professor T. H. McBride gave a talk on "Slime Moulds of Iowa." These organisms are especially interesting not only because of the beauty of the structures themselves but also on account of their relationships to other living things. Are slime moulds plants or animals? The slime moulds of Iowa need investigation. Our flora (regarding them as plants) is comparatively rich in this direction. The proper reference of fruit to plasmodium is as yet little known in many species. Slime moulds exhibit periodicity in their appearance,—sometimes fail in a given locality for years, and then abundantly reappear.

Botanical papers were presented by Professor L. H. Pammel. One was on "Bacteria of Milk." A large number of cultures were exhibited. In the "Report of Committee on State Flora" several interesting species new to the State were mentioned. Muscatine seems to be especially favored with some southern plants, like *Rhexia Virginica*, *Carya olivæformis*, and *C. sulcata*. Weeds like *Solanum rostratum*, *S. carolinense*, *Cuicus arvensis*, etc., are spreading. A third paper was presented on the subject of "Phænological Notes." One of the interesting questions in connection with our flora is the relation that climate has to our wild plants, the time of leafing, flowering, and fall of leaves, as well as the effects of frost on plants. In 1886, the soft maple (*Acer saccharinum*) was in flower on Mar. 22; in 1891, Apr. 11. *Ulmus Americana*, in 1886, in flower, Apr. 12; in 1891, Apr. 18. The succession of flowers in herbaceous plants in 1886 and 1891 was: *Hepatica acutiloba*, Apr. 9 (1886), Apr. 12 (1891); *Capsella Bursa-pastoris*, Apr. 15 (1886), Apr. 24 (1891); *Mertensia Virginica*, Apr. 20 (1886), Apr. 28 (1891). Frost and its effects on some plants were noted: *Portulaca oleracea*, early in September, tips frost-bitten; Oct. 7, more or less destroyed; Oct. 9, plants black in an open field; *Panicum sanguinale*, injured seriously on Oct. 8; *Borrago officinalis*, Oct. 22, a few leaves affected; Oct. 23, many leaves killed; *Scabiosa atropurpurea*, Oct. 7, no injury; Oct. 23, no injury; Nov. 11, no injury; Nov. 21, some injury to leaves. In a paper on "Experiments in the Prevention of Corn Smut," made at the Iowa Experiment Station, it was shown that by treating seed corn with ammoniacal carbonate of copper and copper sulphate no beneficial results were obtained. In plot No. I., treated, there were 6 smutted plants against 8 in check; in plot II., 6 smutted plants against 7 in check; in plot III., 42 smutted plants against 38 in check; in plot VII, 38 smutted plants against 32 in check. These experiments should not be considered as showing conclusively that smut does not enter the delicate tissues of corn by way of the seed. Incidentally he referred to some experiments now carried on at the college farm, in which ammoniacal carbonate of copper, Bordeaux mixture, and other substances were mixed with soil, in which, afterward, corn was planted. Ammoniacal carbonate of copper in the soil retards the germination of corn.

The following papers also appeared on the programme: Miss Minnie Howe, "Some Experiments for the Purpose of Determining the Active Principles of Bread Making;" Dr. N. B. Niles, "The Action of Disinfectants on Nutrient Media;" Professor J. S. Tilton, "Erosion by Middle River for November, 1891."

A committee of five was appointed to ask the legislature to print the Proceedings in connection with the Annual Report of the Iowa Weather and Crop Service. Mr. J. R. Sage, Professors Nutting, Haworth, Davis, and Pammel constitute the committee. The officers of the Academy for 1892 are: C. C. Nutting, president, Iowa City; L. H. Pammel, first vice-president, Ames; E. Haworth, second vice-president, Oskaloosa; Herbert Osborn, secretary and treasurer, Ames; executive council, the officers and J. E. Todd, Tabor; F. M. Nitter, Muscatine; and R. E. Call, DesMoines.

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.*

On request in advance, one hundred copies of the number containing his communication will be furnished free to any correspondent.

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

Traumatic Hypnotism.

HYPNOSIS is a psychical state in which an individual is more than usually susceptible to suggestions. As is well known, the degrees of suggestibility are many. Making the distinction between physiological and pathological hypnotism, the traumatic hypnotism would, of course, fall under the latter head. We have been led to employ the term "traumatic," from an investigation of the following case. The case is all the more interesting, since the patient is a physician.

Patient says: "I was in a village cart coming up the street; the horse was spirited; a man tried to stop him from running away. The last thing I remember is calling to him to get out of the way. The following (of which I was unconscious) has been told me by others: the cart struck another wagon and threw me into the air, and I came down in a heap, as if one were going to dive into the water, striking on my back and side, having the lines wound around my hands. I was pulled forward and up by the horse starting, and dragged about twenty feet, when the lines slipped off of my hands. I did not say anything at this moment; they picked me up for dead and carried me into a drug store. I then began to talk with them, looking deathly pale. They asked me if I was hurt, I answered, 'No, not at all, I am all right.' I would moan every now and then during the conversation. Quite a number of my friends came in, and I called one by name. Then I took off my bonnet and walked back where I could wash my face and hands: I moaned all the time I was doing this; they all thought I knew what I was doing. I walked out towards the hack, but told them I preferred to wait till the crowd got out of the way. On the way home my daughter got into the hack, and I told her not to worry, that I was all right. I walked from the hack into the house. The doctor asked me to sit down, but I said I did not dare to, for I should lose control of myself. I asked to have a pin taken out of my dress. They gave me some whiskey. Then I suggested if it would not be a good idea to take a hot bath. My daughter asked me where the arnica was, and I told her in the office on second shelf, which was correct. Then they gave me the hot bath, and while the servant was pouring some water on my head I came to myself for the first time since calling to the man to get out of the way, but only for a few seconds, hearing only voices and feeling something strike my head, giving pain. I was then taken out of the bath and put into bed; I told them how to unfold the bed; then the doctor put a saturated cloth on the wounded part of my head; I told them to get towels and put them on the pillow to prevent soiling it. Then I began to be very delirious [patient now passes from hypnotic into a delirious state], and talked incessantly about a railroad accident; my husband is constantly on the road and I have worried sometimes about it. I repeated the same things over, saying the railroad switch was wrong, etc. This delirium lasted about an hour. The surgeon arrived, and on putting his finger between the scalp and skull I felt a flash of lightning and saw it. I said 'I cannot stand this pain,' and then I became conscious for the first time of the injury on the back of my head. I was in agony, I could feel distinctly a grating when his finger was put under the scalp, and on pressure in one spot there was a bubbling sensation, that seemed to shoot right over the brain. During this time I was conscious, but did not see anything. It is three weeks since the accident occurred, and I have had headache continually, being a re-echo of the old pain. When I try to read, the right eye sees double; my head feels double; the wounded side feels thick; I have had very unpleasant dreams since."

According to the description of the surgeon, the wound was on the right parietal protuberance over the third descending convolution; it was a contusion.

Inquiries of those who saw the accident and subsequent events confirm the statement of the patient. When picked up her eyes were closed; then water was poured on her head, and she opened her eyes; she could not quite remember her husband's name; then she said she felt better and went and washed her face, etc., as already described.

It is interesting to note the states of consciousness: first, unconsciousness at time of accident; then, water being poured on her head, patient passes into the hypnotic state; this lasts nearly an hour, during which she so conducts herself that her friends do not suspect but that she is herself. During this hypnotic state suggestibility may be said to have been normal, since she responded to every one naturally. Her normal self seemed to control her hypnotic self fully; this latter self was the only one during the hour which was conscious.

Arthur MacDonald.
Georgetown Medical School, Washington, D.C.

Cold Waves.

In the December number of the *American Meteorological Journal* Dr. A. Woeikof has presented a paper on cold waves, in which he attacks with some force views which have been expressed by Professor Russel. The belief that a cold wave is due to the passage of a mass of cold air, which has a vertical diminution in temperature of 1° in 180 feet, at twenty or more miles per hour, over the earth's surface heated sometimes 30° or 40° above the air in contact with it, for a distance of 2,000 miles, without accretion or reinforcement, is certainly unique. It is certain that Dr. Woeikof will not recognize this as his view. He will say that the cold will be added to by radiation from the sod or soil, all the more intense because of the clear, dry air of the cold wave. When we think, however, that, as the cold wave advances at great velocity, the earth's surface is frequently 40° warmer than the air immediately in contact with it, it is difficult to see how the earth's surface can do aught except warm up the air. It seems an inevitable conclusion that a mass of cold air, passing in any direction over the earth, which is itself heated many degrees above the air, must inevitably lose its characteristics in a very short time.

If Dr. Woeikof could study only a very few of our cold waves he would very quickly change his belief. He is at a great disadvantage in that he resides in a country where they have no cold waves, properly speaking. It is well known that in Europe the high areas remain nearly stationary for weeks at a time, and as a result a very abnormal condition of temperature supervenes. The sun shining upon stagnant air heats it up, and this effect becomes cumulative, a little more heat being added each day; besides this, the earth's surface, in this stagnant air, cools down by radiation, as a consequence it frequently happens that the earth's surface is cooler than the air at 10,000 feet; and this has given rise to the most extraordinary theory and one that directly contradicts all known orthodox hypotheses, namely, that in our high areas the air is abnormally heated, while in our storms it is abnormally cooled. It is evident that no discussion of cold waves can be intelligently carried on under such conditions. Dr. Woeikof also suggests that observations at Pike's Peak might be of assistance in studying these phenomena, but this cannot be done at that point for this reason. Pike's Peak is situated on the edge of a plateau about 4,000 feet above sea-level and abnormally heated; also, on the east, there is a marked falling off of the plateau. In consequence, the summit sometimes has the temperature of the plateau and sometimes that of the eastern plain. No cold waves pass over the summit, for the reason that the mountains form a barrier. Most of the cold waves pass down from Manitoba or Assiniboia far to the east or north-east of the mountain.

It would appear that one or two considerations which have an important bearing on this question have been overlooked. For example, it is not proper to think of a cold wave as a mass of cold air having a uniform velocity throughout its height. It is well known that, owing to friction with the earth's surface and other obstructions, the velocity of the air at the earth is much less than at 6,000 feet. It is probable that on Mt. Washington, during the passage of a cold wave, the velocity of the wind is double that at the base. We may consider that the velocity increases uniformly up to this height, or at 3,000 feet it would be about midway between that at the earth and that at the summit. The consequence of this is readily seen. A point in a layer of air at the earth, moving 20 miles an hour, in 10 hours would be 200 miles from its starting-place, but at 6,000 feet a point in the layer would be 400 miles from its first position. If we suppose the temperature diminution in height is 1° in 180 feet at the beginning, and the horizontal temperature difference at the same time is 40° in 200 miles, then, at the end of 10 hours, the vertical diminution in height would become about 1° in 90 feet. The temperature distribution in the latter case would cause a serious disturbance in the equilibrium, according to orthodox views, and there would be an upsetting of the layers, and, in consequence, the cold of the upper layers would ultimately reach the earth. Of course in nature there are no such violent changes, except rarely in summer time, but such an interchange must take place by degrees.

The observations at Mt. Washington abundantly bear out this view. These have been recently published by the Weather Bureau in curves for January, February, and March ("Monthly Weather Review," July to Oct., 1891). On examining the curves we find that in front of a cold wave the diminution of temperature with height is much increased, frequently to more than double the normal, while after the cold wave the temperature is frequently *lower* at the base than at the summit. In other words, the cold wave reaches the summit 5 to 8 hours before it does the base, and the warming up also lags behind, at the base, the same length of time. A neglect of this consideration lies at the bottom of many of Dr. Hann's vagaries regarding temperature distribution in cyclones and anticyclones. Now, if a cold wave is composed of layers of air moving at different velocities as we recede from the earth, it is easy to see that the velocity of the air at the earth need not be that of the cold wave, for the upper layers of air would flow over the lower, bearing along the cold wave, and this cold air would gradually work its way down to the earth.

Until we can obtain observations in free air we must be content with hypotheses and careful study of mountain observations. While no present hypothesis will prove satisfactory in all its details, owing to our ignorance of upper air conditions, yet we can rest assured that the view at the opening of this discussion can by no possibility be correct. E. N.

BOOK-REVIEWS.

The Philosophical Review, Vol. I., No. 1. Edited by J. G. SCHURMAN. January, 1892. Boston, Ginn & Co.

THE establishment in this country of a review devoted to pure philosophy is a noteworthy event, and may prove an event of real importance. The *Review*, we are informed, is to receive "support from private endowments, so that its financial basis is sound and durable;" and though the source of this support is not mentioned, it may be inferred from the fact that the copyright is held by the treasurer of Cornell University, the editor being professor of philosophy in the same institution. The mechanical appearance of the *Review* is similar to that of the *Political Science Quarterly*, the present number containing a hundred and twenty-eight pages. It will be published bi-monthly at seventy-five cents a number or three dollars a year. The editor contributes a prefatory note, in which he announces the character and scope of the *Review* and the attitude it proposes to take "It will aim at the organization, the diffusion and the increase of philosophical knowledge and activity in America," and "will be an organ through which investigators may make known to their fellow-laborers the results of their researches and reflections." The editor takes a roseate view of the prospects of philosophy in America, but the reasons he assigns therefor, except the freedom of American life and thought, do not seem very cogent. It is true that there is now a certain movement of philosophic thought in the country; but it seems to us to be shallow, and no philosopher has yet appeared among us capable of original thought. The *Review*, we are told, "will not be the organ of any institution, or of any sect, or of any interest," but will maintain "impartiality and catholicity of tone and spirit." This is a good rule if well followed; but observation has convinced us that an editor's predilections seldom fail to show themselves in his selection of material. Professor Schurman's views of what is needed in philosophy at the present time seem to us in one respect mistaken. He holds that philosophers ought to devote themselves to the cultivation of special departments, such as logic, psychology, the philosophy of education, etc.; whereas to our mind the crying need of philosophy just now is the relaying of the foundations, and until this is accomplished we see little prospect of fruitful work in any special department.

The leading articles in this issue of the *Review* are three in number, of which the most important is that of Professor Ladd on "Psychology as So-called Natural Science." It is really a critique of Professor James's theory of the nature of psychology and the method of studying it; and the writer has little difficulty in showing that the theory is untenable, and furthermore that Professor James himself is unable to adhere to it with any consistency. Professor John Watson criticises Kant's philosophy from the standpoint of Hegelism, and though his article contains nothing new, it is interesting as renewed evidence that Kant's disciples have become dissatisfied with the outcome of his teaching. Mr. B. I. Gilman contributes the first instalment of a paper "On Some Psychological Aspects of the Chinese Musical System," which shows much curious study, but which seems out of place in a philosophical magazine. Of the book-reviews, which are quite numerous, the ablest is that of Herbert Spencer's "Justice," by the editor of the *Review*, in which he takes essentially the same view of Spencer's doctrines that was taken in these columns when the book was first published. The other reviews are of varying degrees of excellence, some very good and others rather inferior. We must add, too, that some of the books reviewed are not worthy of any notice at all. The concluding portion of the *Review* consists of abstracts of articles in various philosophical magazines — a new feature, we believe, in a periodical of this sort, and one likely to be useful. On the whole, the *Philosophical Review* promises fairly well, and we hope it will prove worthy of its mission.

AMONG THE PUBLISHERS.

THE January number of the *Review of Reviews* contains, as its most conspicuous feature, a sketch of the Czar and the Russia of to-day, written particularly for the American edition of the *Review*, by Mr. W. T. Stead, the English editor. The article contains a number of portraits, and — what will be particularly interesting — a map showing the famine districts, and another showing the so-called "Jewish Pale," the district within which the Jews are permitted to live.

— Macmillan & Co. have in press a translation of Kant's "Kritik der Urtheilskraft," by the Rev. J. H. Bernard, fellow and lecturer of Trinity College, Dublin, and joint author with Professor Mahaffy of "Kant's Critical Philosophy for English Readers."

— Ticknor & Co., Boston, announce "The Norman Monuments of Palermo and Environs," by Arne Delhi and G. H. Chamberlin, architects, in four parts, with fifty measured drawings, several cuts in the text, and many photographic views. The edition will be limited and sold by subscription.

— Readers of Carlyle have often inquired whether it was possible to obtain some accurate text of the course of lectures on literature which he delivered in 1838. They will, therefore, be glad to hear that these lectures are now about to be published by Ellis & Elvey of London. The text now to be issued is derived from the report taken at the time by the late T. C. Anstey, two separate transcripts of which have been in the hands of the publishers.

— An account of that mysterious malady, the grip, by Dr. Cyrus Edson, the chief inspector of the New York Health Department, is published in the January number of *Babyhood*. Dr. Edson traces the history of the grip from ancient times to the present day, describes the symptoms and the mode of treatment, and furnishes valuable aids in the direction of prevention. "Crying and its Significance," by Dr. John Dorning, and "Fat and Thin Children," by Dr. W. L. Carr, are articles that will prove interesting to the readers of that monthly nursery guide. Among the numerous other contributions may be mentioned: "Keeping the Baby Warm," "Children's Lies," "Experiences in Feeding," and a full supply of "Nursery Problems."

— The January number of the *Annals of the American Academy of Political and Social Science* contains two papers on municipal government. They are the article on "The Study of Municipal Government," by Frank P. Prichard, and the article on "The Political Organization of a Modern Municipality," by Wm. Draper Lewis. This number also contains a copy of the by-laws of the Philadelphia Municipal League, an organization whose purpose is the divorce of municipal from national politics. Among the other leading articles in this number are "The Basis of the Demand for the Public Regulation of Industries," by W. D Dabney, "International Arbitration," by Eleanor L. Lord, a strong plea for arbitration as a means of settling international disputes, in place of war. "Jurisprudence in American Universities," by Professor E. W. Huffcutt, a paper of interest to all law students; and "Instruction in French Universities," by Leo S. Rowe. Mr. Rowe has been a student in Paris for the past year, and his paper explains very fully the courses and method of instruction in the colleges of France. A new department has been added to the *Annals* It is entitled "Discussion," and contains papers written in answer to articles which have appeared in the *Annals*. This number also contains the proceedings of the tenth scientific session of the academy, which was held in Philadelphia in November. In the Department of Personal Notes in the January *Annals*, there are brief biographical sketches of the following workers in the field of political and social science: W. C. Ford of Columbia College; A. C. Miller of Cornell; D E Spencer of Harvard; George E.

Howard of Leland Stanford, Jr., University; H. V. Ames of the University of Michigan; W. H. Mace of Syracuse University; Ernest Mischler of Prague; R. H. Inglis Palgrave of London; the late Alfred Jourdan of Aix; Paul Heilborn of Berlin; A. Brückner and George Staehr of Kasan.

— A Spanish edition of the Story of the Nations series is being issued in Madrid under arrangements with the Putnams. Gilman's "Story of the Saracens" in this series is now being printed in raised letters for the use of the blind. The next volumes to be issued in the series are Freeman's "Story of Sicily," Oman's "Story of the Byzantine Empire," and Miss Duff's "Story of the Tuscan Republics."

— With the number for January, 1892, the *Educational Review* opens its third volume. Professor Jenks of Cornell has a paper on "Educational Values," particularly with reference to the college curriculum, and controverting the position taken by Professor Patten in an earlier number. Superintendent Marble of Worcester, Mass., makes some practical suggestions concerning the teaching of the effective use of English. Professor Richards of Yale contrasts the old and the new methods of teaching geometry; and Principal Grant of Queen's College, Kingston, Ontario, replies to Bishop Spalding's earlier argument for religious instruction in State schools. Important articles appear also on school savings banks in England, and the effect of manual training upon health. The discussion on city school supervision is continued by Superintendent Tarbell of Providence, and that on practice teaching by President W. J. Hilne of Albany. Other discussions are by the editor in-chief and Principal Owen of Saco, Me. Book reviews are contributed by Professors McLaughlin and Cameron of Yale, Oren Root of Hamilton, Gill of the Smithsonian Institution, and others.

— *The Electrical Engineer* will begin the new year with a series of articles on the electrical and magnetic discoveries of Professor Joseph Henry — the Faraday of America — by his daughter, Miss Mary A. Henry of Washington, with notes by Mr. Franklin Leonard Pope. Additional and pathetic interest is given this series by the fact that it is practically a vindication by filial hands of Henry's claims to the discovery of magneto-electricity, at a time when his work has been suffered to fall into neglect and oblivion. At the recent Electrical Congress at Frankfort, Germany, the proposition of the American delegates to name after Henry an important new unit applying to facts that he was the first to observe and investigate, failed of assent, and was postponed until the Chicago Electrical Congress of 1893, many of the European delegates saying they had never heard of Henry.

— We may regard it as certain that an apparent connection between infectious diseases and atmospheric conditions had suggested itself to the medical mind long before Sydenham attributed

CALENDAR OF SOCIETIES.

Philosophical Society, Washington.

Jan. 2.—F. H. Newell, Fluctuations of Discharge of Western Rivers; J. R. Eastman, The Mexican Meteorites.

Society of Natural History, Boston.

Jan. 6.—Percival Lowell, Shinto Occultism from a Scientific Standpoint; E. S. Morse, On the Form of the Ancient Bow in Various Parts of the World.

Wants.

Any person seeking a position for which he is qualified by his scientific attainments, or any person seeking some one to fill a position of this character, be it that of a teacher of science, chemist, draughtsman, or what not, may have the 'Want' inserted under this head FREE OF COST, *if he satisfies the publisher of the suitable character of his application. Any person seeking information on any scientific question, the address of any scientific man, or who can in any way use this column for a purpose consonant with the nature of the paper, is cordially invited to do so.*

WANTED.—*Science*, No. 178, July 2, 1886, also Index and Title-page to Vol. VII. Address N. D. C. Hodges, 874 Broadway, New York.

A YOUNG MAN (31) would like a position in a college, laboratory, or observatory, is also willing to assist at a steam engine, etc. Address J. W., care of *Science*, 874 Broadway, New York.

WANTED.—A position in the philosophical or pedagogical department of a college or university by a young man (30) who has had five years' practical experience in teaching, and who has done four years' post-graduate work in philosophy, devoting his attention during the last two years especially to study and original investigation in scientific psychology and its applications in education. Address E. A., care *Science*, 874 Broadway, N. Y. City.

WANTED.—A suitable position in Washington, D. C., not connected with the Government, and with a salary not to exceed $650 a year, by an experienced biologist with six years' university training. Applicant has been a skilful surgeon for fourteen years; is a practical photographer, cartographer, and accustomed to the use of the typewriter. He is also capable of making the most finished drawings, of any description, for all manner of illustrative purposes in science; trained in museum methods and work; also field operations and taxidermy in its various departments, and model ing, production of casts, restorations of paleontological specimens and similar employments. Address U. S. R., care *Science*, 47 Lafayette Place, N. Y.

WANTED.—By a young man (27), B.A. and Ph.D., with three years' experience as assistant in chemistry, position as instructor in chemistry or in natural sciences in college or academy, or other advantageous position as chemist. Give particulars as to work, salary, etc. F. W. MAR, L. Box 23, West Haven, Conn.

Exchanges.

[Free of charge to all, if of satisfactory character. Address N. D. C. Hodges, 874 Broadway, New York.]

Wanted to buy or exchange a copy of Holbrook's North American Herpetology, by John Edwards. 5 vols. Philadelphia, 1842. G. BAUR, Clark University, Worcester, Mass.

For sale or exchange, LeConte, "Geology;" Quain, "Anatomy," 2 vols; Foster, "Physiology," Eng. edition; Shepard, Appleton, Elliott, and Stern, "Chemistry;" Jordan, "Manual of Vertebrates;" "International Scientists' Directory;" Vol. I. *Journal of Morphology;* Balfour, "Embryology," 2 vols.; Leidy, "Rhizopods;" *Science*, 18 vols., unbound. C. T. McCLINTOCK, Lexington, Ky.

For sale.—A 6½ x 8½ Camera; a very fine instrument, with lens, holders and tripod, all new; it cost over $40; price, $25. Edw. L. Hayes, 6 Athens street, Cambridge, Mass.

To exchange Wright's "Ice Age in North America" and Le Conte's "Elements of Geology" (Copyright 1882) for "Darwinism," by A. R. Wallace, "Origin of Species," by Darwin, "Descent of Man," by Darwin, "Man's Place in Nature," Huxley, "Mental Evolution in Animals," by Romanes, "Pre-Adamites," by Winchell. No books wanted except latest editions, and books in good condition. C. S. Brown, Jr., Vanderbilt University, Nashville, Tenn.

For Sale or Exchange for books a complete private chemical laboratory outfit. Includes large Becker balance (200g. to 1-10mg.), platinum dishes and crucibles, agate mortors, glass-blowing apparatus, etc. For sale in part or whole. Also complete file of *Silliman's Journal*, 1862-1885 (62-71 bound); Smithsonian Reports, 1854-1883; U. S. Coast Survey, 1854-1869. Full particulars to enquirers. F. GARDINER, JR., Pomfret, Conn.

For exchange or sale at a sacrifice, an elaborate microscope outfit. Bullock stand; monocular objectives, one-sixth homogeneous immersion, four-tenths, and three inch, Bausch & Lomb, also one-fourth and one inch Spencer. Four eye-pieces. Objectives are the best made. Address Mrs. Marion Smith, 41 Branch Street, Lowell, Mass.

to the atmosphere an "epidemic constitution." The influence of weather would be measured by its effect in providing an environment suitable to germ development. Thus moist weather, whether bleak or warm, would be found conducive to the spread of contagia, and so it is. This fact has often been attested by the extension of cholera, diarrhœa, and the exanthemata. A warm and dry day, on the contrary, tends to check morbid action of an infectious kind. This fact is susceptible of more than one explanation. We may, on the one hand, says *Lancet*, regard it as a consequence of the absence of that germ-fostering condition — humidity; on the other, we cannot fail to be reminded that dry warmth and sunshine give the signal for an exodus from many crowded homes, for their freer ventilation, and consequently for diminution in the intensity of contagia. The exact value of weather changes in regard to this class of diseases, however, still is and must for some time remain *sub judice*. As for the ailments more usually associated with these changes — those, for example, more commonly known as inflammatory — the connection is here much more evident, and also in all likelihood, more direct. The association of pneumonia, bronchitis, asthma, and rheumatism with bleak and wet weather is too invariable to permit of our doubting its reality apart from any suggestion of septic agency.

— Mr. Kelway, according to *Industries*, has introduced an exceedingly simple system of signalling at night. A board is provided with incandescent lamps arranged so that different sets form different letters. If the letter N is wanted, for instance, a key is pressed which lights all the lamps which go to form this letter, and so on. The machine can be worked like a typewriter. Signalling by this means corresponds with the use of the blackboard in the daytime, but is, of course, much more rapid, and at the same time more easily followed. It is, of course, incomparably more rapid than any system of flash signalling, and is easy to read.

Fact and Theory Papers

I. THE SUPPRESSION OF CONSUMPTION. By GODFREY W. HAMBLETON, M.D. 12°. 40c.
"The inestimable importance of the subject, the eminence of the author, and the novelty of his work, all combine to render the little treatise worthy of special consideration. . . . We heartily commend Dr. Hambleton's booklet, and wish there were more such works."—Editorial, *Boston Daily Advertiser.*
"The monograph is interesting in style, scholarly and well worthy of careful consideration. It is devoid of technical expressions, and can be easily read and digested."—*Pharmaceutical Era.*

II. THE SOCIETY AND THE "FAD." By APPLETON MORGAN, Esq. 12°. 20 cents.
"Mr. Morgan founds a sensible and interesting address upon a text furnished by a sentence from a young ladies' magazine; namely, 'Browning and Ibsen are the only really dramatic authors of their century.'"—*New York Sun.*

III. PROTOPLASM AND LIFE. By C. F. COX. 12°. 75 cents.
"To be commended to those who are not specialists."—*Christian Union.*
"Physicians will enjoy their reading, and find in them much food for thought."—*St. Louis Medical and Surgical Journal.*
"Mr. Cox reviews the history of his subject with knowledge and skill."—*Open Court.*
"It is of extreme interest."—*Medical Age.*
"Worthy of a careful perusal."—*Indiana Medical Journal.*
"An interesting and popular account of the tendencies of modern biological thought."—*Popular Science News.*
"All interested in biological questions will find the book fascinating."—*Pharmaceutical Era.*
"The author displays a very comprehensive grasp of his subject."—*Public Opinion.*
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IV. THE CHEROKEES IN PRE-COLUMBIAN TIMES. By CYRUS THOMAS. 12°. $1
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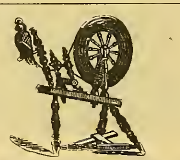

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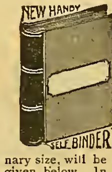

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CONTENTS.

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QUERY.

Can any reader of *Science* cite a case of lightning stroke in which the dissipation of a small conductor (one-sixteenth of an inch in diameter, say,) has failed to protect between two horizontal planes passing through its upper and lower ends respectively? Plenty of cases have been found which show that when the conductor is dissipated the building is not injured to the extent explained (for many of these see volumes of Philosophical Transactions at the time when lightning was attracting the attention of the Royal Society), but not an exception is yet known, although this query has been published far and wide among electricians.

First inserted June 19. No response to date.

N. D. C. HODGES,
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SCIENCE

NEW YORK, JANUARY 15, 1892.

THE KLAMATH NATION.

III.—MYTHOLOGY AND GENERAL ETHNOLOGY.

THE Klamath mythology, as is generally found to be the case with any mythology belonging to a people who speak a language radically distinct from all other tongues, has peculiar features well worthy of notice and of comparison with other and more widely known forms of belief. The principal deity is K'múkamtch, a name which Mr. Gatschet renders the "Old Man of the Ancients," or the "Primeval Old Man." The expression, "man," however, seems in strictness not to be comprised in it, as we are further informed that it is composed of *kmutcha*, "he is old," and the termination *amtch*, having a similar meaning, "old, ancient, primeval, by-gone." "The Most Ancient," or "The Oldest Being," would seem to be the nearest interpretation. He is otherwise designated *P'tishamtch nalam*, "Our Old Father," and *P'laïtalkni*, "The One on High." He created the world and all that it contains. Various stories are told of the mode of these creations. According to one account he made plants and animals, including men, by *thinking* and *wishing*, "this probably implying (as Mr. Gatschet suggests) that, after forming an idea of some creature, he made that idea a reality by the strong energy of his will,"—a method which accords with the Mosaic account of creation. Other myths speak of his family, comprising a father, a wife or wives, a daughter, and Aishish, "his son by adoption." "The name of his daughter," we are told, "is not given, but she represents the clouded or mottled evening sky. When (in the myth) she leads him to the underworld, they meet there a vast crowd of spirits, who for five nights dance in a large circle around a fire, and on each of the intervening days are changed into dry bones. K'múkamtch takes with him some of these in a bag, and, when reaching the horizon at daybreak, throws the bones around the world, in pairs, and creates tribes from them, the Modocs being the last of these. Then he travels in the path of the sun till he reaches the zenith, builds his lodge, and lives there now with his daughter."

Mr. Gatschet holds this divinity to be a nature god, representing usually the sun, but sometimes the sky. He bears a certain likeness to the primal Aryan deity, whose mythological and ethnological history, as *Dyaus-pitar* (Heaven-father) in India, *Zeus pater* in Greece, and Jupiter in Italy, has been so happily traced and elucidated by Professor Max Müller. Like Zeus and Jupiter, also, in the vulgarizing imaginations of later mythologists, he assumes the form of a man or, in his more comic adventures, of a lower animal. He takes then, in Klamath myths, the typical form of the wise and knowing *skel*, the pine-martin, "which changes its black winter fur to a brown coating in the hot months of the year, and thereby becomes a sort of portent to the Indian." As *Skel-amtch*, "Old Martin," he becomes the hero of as many fanciful legends as those of Zeus in his various animal disguises.

His adopted son, Aishish, is the second and, in some respects, the most interesting figure in the Klamath pantheon. His name signifies "the one secreted," or "concealed," and is given to him in allusion to the manner of his birth, which resembled that ascribed in the Greek myth to Bacchus. In his attributes, Aishish rather recalls the other sons of Zeus, Apollo and Hermes, or the Hindoo Krishna. He is beautiful in appearance, beloved and admired by men, and is the husband of many wives, selected by him among the birds, butterflies, and the smaller quadrupeds. He is a social and friendly deity, and often makes his appearance at festive assemblies for archery and gambling (which is deemed a manly and not degrading sport), when he shows himself unrivalled in these accomplishments. He is finely attired in garments of his own making, ornamented with beads. He is constantly at variance with his reputed father. Mr. Gatschet finds his prototype in the moon. "The moon is the originator of the months, and the progress of the months brings on the seasons, with the new life seen sprouting up everywhere during spring and summer. So the quadrupeds and birds, which are the first to appear after the long winter months, are considered as the wives of Aishish, and the flowers of summer vegetation are the beads of his garments."

The other elementary deities of the Klamaths are mysterious shadowy beings, too dimly defined, in our author's opinion, to deserve the name of gods. Among them are Kaila, the earth; Leméish, the thunder; Yamash and Muash, the north and south winds; and Shukash, the whirlwind. There are mythic stories relating to spirits of the dead, to giants and dwarfs, and to deified animals. But none of them seem to be of much real significance, or to influence greatly the lives of the people. Their mythology, like their traditional history, was cramped in its development by a peculiar superstition, which strictly forbade the utterance of the name of any deceased person. This superstition made the worship of ancestors impossible, limited all thought about a future life, and abolished all historical tradition,—for, as the author pertinently asks, "How can history be told without names?" The Klamath religion, therefore, appears simply as the reverence for certain nature-powers. It has no torturing or mangling rites, like the flesh-piercing and finger-mutilation of the Dakota and Blackfoot tribes, and no grossly immoral and anti-social traits, like some of the Mexican and Peruvian observances.

The belief in a future life, though obscured, is not entirely extinguished by the superstition which has been mentioned. The disembodied soul, now a nameless phantom, hovers for a time about its late abode, and then, rising in the air, follows the sun in its westerly course, till it reaches the spirit-land in the sky, E-eni, or Ayayani, "somewhere near K'múkamtch." "Its arrival there is afterwards revealed by dreams to the mourning relatives, who express in songs what they have seen in their slumbers." There is a guardian, we are told, over the spirits in their passage through the sky, called the Wásh Kmush, or the *gray fox*. "This name is evidently borrowed from the coloring of the sky, as it appears during a polar night, and must be compared to another beast name, Wáu or Wanáka, the *red fox*, which is the symbol of the sun-halo." Not all souls, however, attain the home of the spirits. Of Kmúkamtch we are told, "He provides for mankind whom he has created, but does not tolerate any contravention of his will; for he punishes bad characters by changing them into rocks or by burning them." Thus we find that the Klamath mythology, like the Greek, though in many parts childish, absurd, and inconsistent, had yet, in a certain degree, reached the important point where religion is combined with morality.

Mr. Gatschet promises, in a future volume, some further information concerning the social usages of the Klamath nation. But he adds a few weighty sentences on this subject, which deserve special consideration. "The Klamath Indians," he tells us, "are absolutely ignorant of the gentile or clan system as prevalent among the Haida, Thlingit, and the Eastern Indians of North America. Matriarchate is also unknown among them; every one is free to marry within or without the tribe, and the children inherit from the father." According to certain theories which have been proposed of late years by writers of much eminence, the Klamath nation would appear from these facts to have reached a very high degree of social advancement. It has emerged from the primal and bestial condition of promiscuous intercourse, euphemistically and absurdly styled "communal marriage;" it has passed through the "gentile" organization, and the matriarchal and exogamous stages, and has attained the loftiest grade of the most highly civilized European nations. The recent admirable work of Mr. Edward Westermarck on the "History of Human Marriage" has disclosed the unsubstantial character of the bases on which these fantastic theories were reared. But to get to the root of the matter something further should be said, or rather has been already said, and may here be repeated. In the volume for 1889 of the British Association for the Advancement of Science, I have expressed, in some "Remarks on North American Ethnology," introductory to the excellent report of Dr. Franz Boas on the Indians of British Columbia, the conclusions to which — in common, I think, with most American ethnologists — I have been led by a prolonged study of the tribes of this continent and a comparison of them with other tribes and races. As these conclusions have since been strongly reinforced by the results of the careful investigations of Mr. Gatschet and Dr. Boas, as well as by the comprehensive studies of Dr. Brinton, as set forth in his valuable works on "Races and Peoples" and "The American Race," I may venture to add a summary of them as a fit completion of the present review.

I have urged that "in our studies of communities in the earliest stage we must look, not for sameness, but for almost endless diversity, alike in languages and in social organizations. Instead of one 'primitive human horde' we must think of some three or four hundred primitive societies, each beginning in a single pair or group of children bereft of their parents, and left, in the early settlement of a country, isolated from all kindred and neighbors, each pair or group expanding in their posterity to a people distinct from every other, alike in speech, in character, in mythology, in mode of government, and in social usages. The language may be monosyllabic, like the Khasi and the Paloung; or agglutinative in various methods, like the Mantshu, the Nahuatl, the Eskimo, and the Iroquoian; or inflected, like the Semitic and the Sahaptin. Its forms may be simple, as in the Malayan, the Maya, and the Haida, or complex, as in the Aryan, the Basque, the Algonkian, and the Athapascan. The old theoretical notion, that the more complex and inflected idioms have grown, in the process of ages, out of the simpler agglutinative or monosyllabic forms, must be given up as inconsistent with the results of modern researches.

In like manner, we find among primitive communities every form of government and of social institutions — monarchy among the Mayas and the Natchez, aristocracy among the Iroquoians and the Tshimsians, democracy among the Algonkians and the Shoshonees, descending almost to pure, though perhaps peaceful, anarchy among the Athapascans, the Eskimos, and various other families. In some stocks we find patriarchal (or 'paternal') institutions, as among the Salish and the Algonkian; in others, matriarchal (or 'maternal'), as among the Iroquoian and the Haida. In some the clan-system exists; in others it is unknown. In some exogamy prevails; in others endogamy. In some, women are honored, and have great influence and privileges; in others they are despised and ill-treated. In some, wives are obtained by capture, in others by courtship, in others by the agreement of the parents. All these various institutions and usages exist among tribes in the same stage of culture, and all of them appear to be equally primitive. They are simply the forms in which each community, by force of the special character of its people, tends to crystallize.

We frequently, however, find evidence, if not of internal development, at least of derivation. Institutions, creeds, and customs are in many cases adopted by one stock from another. As there are now 'loan-words' in all languages, so there are borrowed beliefs, borrowed laws, and borrowed arts and usages. Then, also, there are many mixed communities, in which, through the effect of conquest or of intermarriages, the physical traits, languages, or institutions of two or more stocks have become variously combined and intermingled. In short, the study of human societies in the light of their classification by linguistic stocks is like the study of material substances in the light of their classification by the chemical elements. In each case we find an almost infinite variety of phenomena, some primitive and others secondary and composite, but all referable to a limited number of primary constituents: in chemistry, the material elements; in ethnology, the linguistic stocks. Such is the result of the latest investigations, as pursued on the Western Continent, where for the first time a great number of distinct communities, in the earliest social stages, have been exposed to scientific observation, with all their organizations and workings as clearly discernible as those of bees in a glass hive."

It is to be hoped that the Bureau of Ethnology and the British Association will continue their valuable researches and publications on this subject until all the distinct aboriginal stocks which survive in western North America, from Alaska to Lower California, have been as thoroughly studied and their physical and mental traits, languages, mythologies, and social systems made known as completely as this can now be done. From a comparison of the results of these inquiries two important gains to science may be confidently anticipated. (1) It will be made evident — as the facts already adduced in this review sufficiently show — that the physical differences in the varieties of men can be adequately explained by climatic and other local influences, and thus all ground for affirming the existence of several human species, evolved from different sources, will disappear. (2) The "Aryocentric" theory of linguistics and ethnology, which, during the past seventy years, has perverted and hampered those sciences as seriously as the geocentric theory for many centuries perverted and hampered the science of astronomy, will be utterly demolished. All the special excellences which have been claimed for the speech and mental traits of the Indo-European stock, will be found exemplified in as high degree among some of the American nationalities. The singular opinion which has been maintained by writers of no mean distinction, that the descendants of a barbarous community of nomadic herdsmen who, four or five thousand years ago, wandered over the central plains of Asia and Europe, and, moving southward, gradually gained from Assyrian, Egyptian, and Dravidian sources the elements of culture, are endowed by nature with certain peculiar gifts of intellectual and moral greatness which entitle them to subdue, dominate, regulate, and, if they think proper, entirely suppress and exterminate any alien community that comes in their way, will be found to be as directly opposed to scientific truth as it is to the first principles of humanity and justice. HORATIO HALE.

Clinton, Ontario, Canada.

THE LAFAYETTE GRAVELS.

PRESIDENT CHAMBERLIN, accompanied by Professor R. D. Salisbury, has spent the holidays in the south and southwest, examining the beds of gravel and sand called by Dr. Hilgard the "Orange Sand," but recently renamed by him "Lafayette." The same beds have also been called "Appomattox" by Mr. McGee. The party went first into the north-western part of Alabama and adjacent parts of Mississippi, where this formation, as well as an older one composed of very similar materials, is seen in great force. This older formation is the Tuscaloosa of the Alabama survey, equivalent to the Potomac of the Middle States. From Sheffield they went across to Columbus, Ga,, where they were joined by Mr. W. J. McGee. At Columbus the same two formations are admirably exposed, as well as a third, a division of the Columbia formation of Mr. McGee, the "River Terrace" of the Alabama survey.

From Columbus the party came to Montgomery, where the Lafayette gravels and sands are to be seen in contact with the sands of the Eutaw division of the Cretaceous. From Montgomery they went to Tuscaloosa, where they were met by Dr. Smith and spent a day in examining the beautiful exposures of the Tuscaloosa and Lafayette formations in the railroad cuts at Cottondale, at Box Spring, and in the gullies of the town of Tuscaloosa. Sir Charles Lyell, in describing the geological formations at Tuscaloosa, says: "The lower beds of the horizontal Cretaceous series in contact with the inclined coal measures, consist of gravel, some of the quartzose pebbles being as large as hens' eggs, and they look like an ancient beach, as if the Cretaceous sea had terminated here, or shingle had accumulated near a shore."[1]

Professor Tuomey afterwards showed that these pebble beds belonged to a much more recent formation, for he traced them southward and found them overlying the Tertiary rocks of the lower part of the State.[2]

As a matter of fact, both the Cretaceous (if the Tuscaloosa or Potomac shall prove to be Cretaceous, as seems most probable) and the Post-Eocene deposits are exposed in the gullies cut in the slopes of the hill towards the river in Tuscaloosa. All the large gravel belongs, however, in all probability, to the later formation, which we now call Lafayette, while the underlying stratified clays and cross-bedded sands are of older date, the clays containing many plant remains which fix the age as probably Cretaceous. It thus seems that Sir Charles Lyell was mistaken in his identification of the gravel beds as Cretaceous, while Professor Tuomey, though undoubtedly correct in his classification of the gravel and overlying red loam, did not discriminate between these and the underlying laminated clays and cross-bedded sands, which were first clearly distinguished in Alabama by Harper and Winchell, and afterwards described in detail by Smith and Johnson in 1883 and following years.[3]

The age of these later gravels has lately become matter for difference of opinion among geologists. Professor Tuomey thought that they belonged to the Drift, though having but few points of resemblance to that formation at the north. Dr. Hilgard also has always considered them as belonging to the Quaternary, and, more or less remotely, of glacial origin. Messrs. McGee and Chamberlin, on the other hand, consider them much older than the Quaternary, and as probably Pliocene, because of their occurrence beneath beds which these geologists consider the very oldest of the Quaternary series. The vigorous manner in which the study of this formation is being pushed in widely-separated parts of the United States, leads us to hope that these differences of opinion will soon be reconciled.

From Tuscaloosa the party went westward to Vicksburg, Natchez, and other points on the great river, where the same gravel beds are exposed in contact with the overlying Port Hudson and Loess of unquestioned Quaternary age. From New Orleans the party will return to their homes.

E. A. S.

[1] "Travels in the United States, Second Visit," Vol. II., p. 68 (Harper & Bro.).

[2] "First Biennial Report on the Geology of Alabama," p. 160.

[3] Bulletin No. 43, U. S. Geol. Surv., "On the Tertiary and Cretaceous Strata of the Tuscaloosa, Tombigbee, and Alabama Rivers."

ARTIFICIAL LANGUAGES.

THE enthusiasm for the creation of new international languages was at its height a few years ago, but is by no means over. The too well-known *Volapük* is probably the best of them, and has set the stone rolling; it tries to combine the peculiar, especially phonetic, features of most European languages. It is doing good work as a medium of commercial correspondence, but probably will never be adopted as a medium for conversation, and through the agency of time is subjected, like other languages, to phonetic and many other changes. Some attempts dating from 1891 have adopted the principle of uniting the elements of the Romance languages only into a new form of speech. "Un lingua internazional" was composed by Julius Lott in Vienna (Springergasse 32); "Un lingue commun pro le cultivat naziones" by Dr. Alberto Liptay and "fixed up" for Spanish, French, and German speaking people; another, perhaps the most consistent in its principle, is "Nov Latin," by Dr. Rosa of Turin. A passage taken from Lott's "Suplent folie" reads as follows: "Le doktes inter si pote usare le historĭk ortografie, ma le homo de komercie ese saep in dubie en use de dublkonsonantes. Sin perdite pro le klarité noi pote tolerare le skripzion; gramatik pro grammatika, etc. In il question le majorité averé le decision." In reading this sort of jargon we cannot help asking ourselves, Would it not be greatly preferable to use plain French or Italian to make oneself understood?

Another more elaborate "Attempt towards an International Language" was written by Dr. Esperanto of Warsaw, Russia, and translated into English by Henry Phillips, Jun. (New York, Holt, 1889. 56 p. 8°). It combines radical elements of the Germanic and the Romance languages, and tends to put into reality the principle, that "a language of this kind must be extremely easy, so that it can be learned without difficulty." Indeed, Esperanto's grammatic rules are few in number, for they are all gathered upon four pages only. A part of the Lord's Prayer sounds as follows: "Panon nian chioutagan donu al nihodiaŭ; kaj pardonu al ni shuldantoj; ne konduku nin en tenton, sed liberigu nin de la malvera char." An International-English and an English-International vocabulary stands at the close of the small volume. The real name of the author who has hidden himself and his ingenious system under the pseudonym of "The Hopeful" is Dr. Samenhof.

NOTES AND NEWS.

IT has been long known that glass is attacked and dissolved in small quantities by ordinary water. This dissolving process Herr Pfeiffer, according to *Nature*, has recently sought to prove and measure by change in the electric conductivity of the water (*Ann. der Physik*). He measured the increase of conductivity undergone by one cubic centimetre of pure water when it has been in contact for one hour with one square centimetre of glass surface, and concluded that the amount of glass dissolved at 20° C. was one to two millionths of a milligram. He found, too, that with temperature rising arithmetically, the growth of solubility is considerably more rapid than that of a geometrical series; that the increase of conductivity of the water for a given kind of glass under like conditions is a characteristic constant; and that later, when a certain quantity of alkali is dissolved, further action involves a dissolving also of silicic acid, and the salts then formed may cause a decrease of conducting power.

— R. W. Shufeldt, M.D., delivers, during January, four lectures on biology, at the Catholic University of America, Washington. The titles are: "Its History and Present Domain," "Its Relations to Geology," "Its Value as a Study," "Its Growth and Future Influence."

— Towards the end of last March the citizens of Sydney were astonished, as we learn from *Nature*, by the sudden discoloration of the water in Port Jackson. In the harbor the water presented in many places the appearance of blood. This remarkable phenomenon, which was soon found to be due to the presence of a minute organism, has been made the subject of a paper, by Mr. Thomas Whitelegge, in the Records of the Australian Museum (Vol. I. No. 9). On March 31, Mr. Whitelegge went to Dawe's Point and got a bottle of water, in which there was a good supply of the organism in question. At first he thought it was a species of the genus Peridiniidæ; but further research convinced him that it was a new species of the closely allied genus, Glenodinium. So far as Mr. Whitelegge is able to judge, fully one half of the shore fauna must have been destroyed by these small invaders. The bivalves were almost exterminated in those localities where the organism was abundant during the whole of the visitation. Mr. Whitlegge is of opinion that the great destruction of life brought about by an organism apparently so insignificant is of the highest interest from a biological point of view, showing, as it does, how limited is our knowledge of the causes which influence marine food-supplies. This, he points out, is particularly the case in regard to the oyster, which has often mysteriously disappeared from localities where it formerly abounded.

— In a report by the British vice-consul at Alexandria, it is stated that the plague of locusts which has been devastating Morocco has been extending itself to Egypt. Some little time ago, clouds of locusts made their appearance and settled, for the most part, on the banks of the Nile or on the edge of the desert, forming large yellow patches, easily discernible at a distance. They at once began to breed, and, although immediate steps were taken to destroy them, large numbers of the eggs have already been hatched. An examination of about thirty deposits of eggs is said to have shown that the usual number laid by each female is from ninety-seven to a hundred. The government at once issued the strictest orders to the mudirs to use every possible means to destroy the locusts, and competent officials were sent round the country to organize and direct the work of extermination. Millions of locusts and eggs have been destroyed, but there are still large numbers in the country. When eggs are discovered, either the field is ploughed up or flooded, or the eggs are collected and destroyed. The old locusts are easily destroyed while breeding, but the young crickets, in the earliest stage, when they are hopping about in every direction, give more trouble. The usual method followed in this case is to enclose the spot in which the crickets are found by a number of men drawn up in the form of a crescent. A ditch is then dug from one horn of the crescent to the other, and the men close in, driving the young locusts, by means of palm branches, into the ditch, where they are destroyed and buried. When the young locusts are further developed, they cease to hop, and march in densely packed armies. It is at this stage that they are said to be most destructive, but they are more easily exterminated, as they move slowly, and can be surrounded with fuel and burned. From the energetic measures taken by the government, it is hoped that this pest may be stamped out before any serious harm has been occasioned, but as many eggs are still known to be deposited in the country, it is impossible to foretell the extent of the calamity, and it is possible that many eggs are being hatched in the desert. Up to the present time it is reported that little damage has been done to the cotton crops, but it is difficult to obtain any reliable information on the subject. The system employed in Cyprus for the destruction of locusts has been adopted in Egypt when practicable. Another insect plague, in the shape of a repulsive-looking scale insect, made its appearance in Alexandria some time ago, and last year committed great ravages in the gardens adjacent to the town, attacking trees, shrubs, and the fruit of the date palm. Various measures have been tried, but the only efficacious one appears to be that of cutting the branches and carefully brushing the boughs. Unfortunately, however, no general regulation has yet been put into force, and consequently the efforts of some individuals are nullified by the apathy of others, and the plague still continues and threatens to spread throughout the country. The insect has been classified as *Crossotoma Ægyptiacum*, and was probably imported from America It is popularly known as *cotonina*, from its resemblance to cotton. A decree has now been issued, prohibiting the transport of trees and shrubs from Alexandria to other parts of the country.

— A large and influential meeting has been held in the Liverpool Town Hall, the Mayor in the chair, for the purpose of establishing a geographical society for the city. It was decided, on the motion of Mr. Forwood, M P., to establish such a society. Mr. Forwood said that statesmen had a knowledge of continents, but they had no knowledge of the value of the trade in these continents. He felt sure that if, some years ago, those who were at the head of public affairs in this country had been informed by a practical society, such as he had no doubt would be formed in Liverpool, that in Africa there were great resources, that there was a great field for the expansion of this country's trade, the condition of the map of Africa would be very different from what it now was. He had before him a map prepared by the African section of the Chamber of Commerce, which showed that the coast lines of different countries interlaced, but that no arrangement seemed to have been made by any one of them as to who was to have the sphere of influence in the interior. Many railways had been by British enterprise recently built in Mexico, Central America, and the Argentine, but there was really nothing known in this country about the resources of these countries, and there was no place where this information could be got. Such a centre of information in Liverpool would be of inestimable value. Probably their society would take a more practical and less scientific line than the Royal Geographical Society, who were giving them their cordial sympathy and support.

— The Meteorological Office of Paris has recently published its Annals for the year 1889, in three volumes, as in previous years. Vol. I., under the title of Memoirs, says *Nature*, contains a treatise by M. Fron on the course of the thunder-storms during the year, accompanied by daily charts. M. Moureaux has published the details of the magnetic observations made at St. Maur, with a summary of the disturbances; eight plates reproduce exactly the photographic curves of the most remarkable disturbances. M. Angot gives the results of the first simultaneous observations made at the Central Meteorological Office and on the Eiffel Tower. The diurnal variation of pressure at the summit of the tower shows that the first minimum (4h.–5h. A.M.) is much more pronounced in all months at the summit than at the base, and appears to occur rather later. The first maximum (9h.–10h. A.M.) is much less important at the summit, especially during the summer months, and also appears to occur later. The second minimum (2h.–3h. P.M.) is much less important at the summit, and the second maximum (about 10h. P.M.) is rather more pronounced at the summit than at the base. The temperature of the air at the summit of the tower during the night differs constantly from that of St. Maur by less than the normal value; during the day, on the contrary, the difference of temperature is much greater between the two stations than the normal value. The wind, during all months, has a diurnal variation quite different from that at the Central Office; the maximum occurs at the middle of the night, while the minimum occurs at about 10h. A.M., and rather later in winter. Vols. II. and III. contain respectively the general observations and the rainfall values at the various stations.

— Two theories have been proposed to explain the formation of blowholes in steel castings, neither of which has so far succeeded in satisfying all parties. When it was discovered at Terrenoire that an addition of silicon to the molten metal tended towards the production of sound castings, the theory was advanced that the blowholes were due to carbonic oxide, which compound is broken up by silicon at high temperatures. But the discovery that the gas contained in these blowholes was principally hydrogen and nitrogen, with but a small proportion of carbonic oxide, did much to unsettle this theory, though its advocates by no means abandoned the field. In a recent work, M. Le Berrier, Engineer-in-Chief of mines and professor at the Conservatoire des Arts et Métiers, has proposed a theory, according to *Engineering*, which accounts for the effect of silicon in producing sound castings and also for the presence of hydrogen in these blowholes. According to him, a bath of cast steel is a super-saturated solution of hydrogen and nitrogen. If it solidifies quietly, nothing disturbs the molecular equilibrium, but if, by a secondary reaction, bubbles of some other gas are produced in the body of the molten fluid, this disengagement, feeble as it may be, destroys the equilibrium, just as in a super-saturated solution of a gas in a liquid, the passing in of a few bubbles of some other gas may cause the disengagement of the first. This carbonic oxide, though forming only a small part of the total gas set free, is quite capable of liberating the other gases with which the blowholes are mainly filled.

— The Brooklyn Institute of Arts and Sciences January Bulletin is as follows: Jan. 4, Department of Microscopy, lecture by W. J. Kerstetter of New York on "Nature as Revealed by the Microscope;" Jan. 5, Department of Philology, first lecture in the series on "The Modern Novel," by Professor Hjalmar H. Boyesen of Columbia College, "Victor Hugo," with personal reminiscences; Jan. 5, Department of Entomology, lecture by Professor George Macloskie of Princeton College on "Some Notes on the Physiology of Insects;" Jan. 6, Department of Geology, lecture by Professor Henry L. Fairchild of Rochester University on "The Age of Reptiles;" Jan. 7, Department of Political and Economic Science, lecture by Mr. Elio S. Youtcheff, a Bulgarian exile, on "The Policy of the Czar in the Expulsion of the Jews and the War Movement in Europe;" Jan. 7, Department of Painting, meeting at the Brooklyn Art Association Building; Jan 8, Regular Monthly Meeting of the Board of Trustees; Jan. 8, Department of Electricity, illustrated lecture by Mr. Osborn P. Loomis on "Practical Experiences in Dynamo Designing;" Jan. 9, Department of Political and Economic Science, first lecture in the course on "The Great Political Leaders of the Empire State," by Professor Charles H. Levermore of the Massachusetts Institute of Technology, Boston, "William Livingston and the Sons of Liberty;" Jan 11, Department of Astronomy, paper by Mr. Garrett P. Serviss, president of the Department, on "The Periods of Rotation of Mercury and Venus;" Jan. 11, Annual Meeting of the Corporation of the Institute for Election of Trustees; Jan. 12, Department of Philology, lecture in the series on "The Modern Novel," by Professor Hjalmar H. Boyesen, "The French Novel;" Jan. 12, Department of Engineering, lecture by Mr. C. J. H. Woodbury, vice-president of the Boston Manufacturers' Fire Insurance Company of Boston, on "The Proper Construction of Buildings to Resist Destruction by Fire;" Jan. 13, General Meeting of Members of the Institute, lecture by Sir Edwin Arnold on "The Light of the Orient;" Jan. 14, Department of Zoology, lecture by Mr. Ernest Ingersoll of New York on "The Embryology and Structure of the Turtle;" Jan. 15, Department of Psychology, first lecture in the course on "The Psychology of Aesthetics," by Dr. Benjamin Ives Gilman of Cambridge, Mass., "Musical Notes;" Jan. 15, Department of Geography, lecture by Mr. Robert D. Benedict on "The Hereford Map of the World," or "The World as Known in the Thirteenth Century;" Jan. 16, Department of Political and Economic Science, second lecture in the course on "The Great Political Leaders of the Empire State," by Professor Charles H. Levermore, "The Clintons and the Rise of the New York Democracy;" Jan. 18, Department of Archæology, lecture by Professor Daniel G. Brinton of the University of Pennsylvania on "The Origin and Early Distribution of the White Race;" Jan. 18, Department of Physics, by invitation of the secretary of the Pratt Institute, the Department will visit and inspect the work of that institution; Jan. 19, Department of Philology, lecture in the course on the Modern Novel, by Professor H. H. Boyesen, "Realism and Romanticism;" Jan. 19, Department of Botany, lecture by Dr. Smith E. Jelliffe, curator of the Department, on "Mosses;" Jan. 20, Department of Architecture, lecture by Professor A. D. F. Hamlin of Columbia College on "The Great Museums of Europe;" Jan. 20, Department of Mineralogy, General Exhibition of Minerals from the Famous Patterson Quarries; Jan. 21, General Meeting of the Members of the Institute, address by the Rt. Rev. John J. Keane, president of the Catholic University of America, on "Leo XIII. and the Social Problems of the Day;" Jan. 22, Department of Psychology, lecture in the course on the "Psychology of Aesthetics," by Dr. Benjamin Ives Gilman, "Simultaneous Structure, Chords;" Jan. 22, Department of Electricity, lecture by Dr. A. D. Rockwell of New York on "The Uses of Electricity in the Treatment of the Human Body;" Jan. 23, Department of Mathematics, subject for discussion: "The Teaching of Geometry;" Jan. 23, Department of Political and Economic Science, lecture in the course on "The Great Political Leaders of the Empire State," by Professor Charles H. Levermore, "Martin Van Buren and the Triumph of the New York Democracy;" Jan. 25, Department of Music, the Second Concert given by the Department will be conducted by Mr. Max Spicker, first vice-president of the Department, assisted by Mr. Arthur Friedheim, piano; Mr. Richard Arnold, violin; Mr. Rudolph Nagel, cello; and Miss Olive Fremstadt, alto; Jan. 26, Department of Philology, lecture in the series on "The Modern Novel," by Professor H. H. Boyesen, "The Russian Novelists and Nihilists;" Jan. 26, Department of Photography, lecture to be announced; Jan. 27, Department of Philology, French Section, lecture by Professor Charles Sprague Smith of New York on "Victor Hugo's L'Année Terrible;" Jan. 27, Department of Physics, lecture by Mr. Walter H. Weed of Washington, member of the U. S. Geological Survey, on "Geysers and the Physics of Geyser Action;" Jan. 28, General Meeting of the Institute, address by the Hon. Theodore Roosevelt, United States Commissioner of the Civil Service, on "The National Service;" Jan. 29, Department of Psychology, lecture in the course on "The Psychology of Aesthetics," by Dr. Benjamin Ives Gilman, on "Successive Structure, Measure;" Jan. 29, Department of Chemistry, lecture by Mr. Lucien Pitkin of New York on "The Germ Theory in its Relation to Sanitary Chemistry;" Jan. 29, Department of Philology, German Section, lecture by Professor Frederick W. Grube on "The Philology of German Case Endings;" Jan. 30, Department of Political and Economic Science, lecture in the course on "The Great Political Leaders of the Empire State," by Professor Charles H. Levermore, "Thurlow Weed, William H. Seward, and the Rise of the Republican Party."

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PRISMATIC SANDSTONE FROM MISSOURI.[1]

ON the right bank of the St. Francois River, in S. 31; T. 33, N.; R. 6 E., about 200 yards south-west of the St. Louis Granite Company's quarry, near Knob Lick, in Madison County, Mo., is a little sandstone ridge, trending north-west and south-east, nearly 200 yards long, 10 yards wide, and not more than 8 to 10 feet high above the nearly level ground on either side. The country rock here is the Cambrian sandstone, which overlies the granite, as is beautifully illustrated at the quarry near by. This little ridge is interesting on account of the peculiar form of the sandstone composing it. In places where the soil has been somewhat worn away, instead of revealing flat layers of sandstone, as can be found near by in any direction, the surface is covered with fragments of sandstone of a prismatic form, resembling in shape the basaltic columns so well known in different parts of the world. In size the prisms range from about three-fourths of an inch to one and a half inches in diameter, and from three to eight inches in length. They are not uniform in geometrical outline, some having four sides, some five, and a few six. Quite often two and occasionally three prisms adhere together, side by side, but generally so loosely that they can easily be broken apart. In such cases the boundary between them is usually a single plane, but sometimes two new planes are exposed by the breaking, forming a re entrant angle on one prism. Fig. 1 fairly represents a combination of two of these prisms.

The nature of the rock was studied quite carefully, both macroscopically and microscopically, and it was found to be nothing but an ordinary, somewhat irregularly indurated, fine-grained sandstone. The grains of quartz are water-worn, as is usual. The induration is produced by the interstitial spaces being more or less filled with silica, but the thin sections examined showed no instance of secondary growth of the quartz crystals.

[1] Published by consent of the State Geologist of the Geological Survey of Missouri. Read before the Iowa Academy of Sciences, Des Moines, Dec. 30, 1891.

The existence of the ridge is probably due to the induration of the sandstone. Why this limited area should be thus indurated, and the surrounding country should not be, there seemed to be no obtainable evidence. However, this of itself is of little importance But the prismatic form of the sandstone is much more interesting. The specimens gathered were on or near the surface, and were not seen *in situ;* but from their great abundance it must be argued that they extend downwards for a considerable distance. It was first thought that possibly a dike rock had once existed here, which had assumed the prismatic character, and that in some way by surface decay it had left moulds into which the sand had been carried. But a careful examination revealed no indication whatever of there ever having been a dike here, although they are quite common in the surrounding country. The granite close by is older[2] than the sandstone, and could not therefore have played any part in the matter by metamorphosing the sandstone in any way.

FIG. 1.

If any of the readers of *Science* know of any other occurrence similar to this, or can suggest any cause likely to have produced this peculiar formation, it is hoped they will give the information through the columns of *Science.*

ERASMUS HAWORTH.
Oskaloosa, Iowa.

ORTHOGRAPHY OF GEOGRAPHICAL NAMES.

IN 1885 the Council of the Royal Geographical Society, impressed with the necessity of endeavoring to reduce the confusion existing in British maps with regard to the spelling of geographical names, in consequence of the variety of systems of orthography used by travellers and others to represent the sound of native place-names in different parts of the world, formally adopted the general principle which had been long used by many, and the recognition of which had been steadily gaining ground, viz., that in writing geographical native names vowels should have their Italian significance and consonants that which they have in the English language. This broad principle required elucidation in its details, and a system based upon it was consequently drawn up with the intention of representing the principal syllabic sounds.

It will be evident to all who consider the subject that to ensure a fairly correct pronunciation of geographical names by an English-speaking person an arbitrary system of orthography is a necessity. It is hardly too much to say that in the English language every possible combination of letters has more than one possible pronunciation. A strange

[2] See Bull. No. 5, Mo. Geol. Surv., p. 12, et seq.

word or name even in our own language is frequently mispronounced, — how much more with words of languages utterly unknown to the reader. The same necessity does not arise in most continental languages. In them a definite combination of letters indicates a definite sound, and each nation consequently has spelt foreign words in accordance with the orthographic rules of its own language. It was therefore not anticipated that foreign nations would effect any change in the form of orthography used in their maps, and the needs of the English-speaking communities were alone considered.

The object aimed at was to provide a system which would be simple enough for any educated person to master with the minimum of trouble, and which at the same time would afford an approximation to the sound of a place name such as a native might recognize. No attempt was made to represent the numberless delicate inflections of sound and tone which belong to every language, often to different dialects of the same language. For it was felt not only that such a task would be impossible, but that an attempt to provide for such niceties would defeat the object.

The adoption by others of the system thus settled has been more general than the council ventured to hope. The charts and maps issued by the Admiralty and War Office have been, since 1885, compiled and extensively revised in accordance with it. The Foreign and Colonial Offices have accepted it, and the latter has communicated with the colonies requesting them to carry it out in respect to names of native origin. Even more important, however, than these adhesions is the recent action of the Government of the United States of America, which, after an exhaustive inquiry, has adopted a system in close conformity with that of the Royal Geographical Society, and has directed that the spelling of all names in their vast territories should, in cases where the orthography is at present doubtful, be settled authoritatively by a committee appointed for the purpose. The two great English-speaking nations are thus working in harmony. Contrary to expectation, but highly satisfactory, is the news that France and Germany have both formulated systems of orthography for foreign words, which in many details agree with the English system. The Council of the Royal Geographical Society, by printing the rules in "Hints to Travellers," and by other means, have endeavored to ensure that all travellers connected with the society should be made aware of them; but as it is possible that some bodies and persons interested in the question may still be in ignorance of their existence and general acceptance, they feel that the time has come again to publish them as widely as possible, and to take every means in their power to aid the progress of the reform. To this end, and with a view to still closer uniformity in geographical nomenclature in revisions of editions of published maps, a gigantic task requiring many years to carry out, the council have decided to take steps to commence tentatively indexes of a few regions, in which the place-names will be recorded in the accepted form.

The rules referred to are as follows: —

1. No change is made in the orthography of foreign names in countries which use Roman letters: thus Spanish, Portuguese, Dutch, etc., names will be spelt as by the respective nations.

2. Neither is change made in the spelling of such names in languages which are not written in Roman characters as have become by long usage familiar to English readers: thus Calcutta, Cutch, Celebes, Mecca, etc., will be retained in their present form.

3. The true sound of the word as locally pronounced will be taken as the basis of the spelling.

4. An approximation, however, to the sound is alone aimed at. A system which would attempt to represent the more delicate inflections of sound and accent would be so complicated as only to defeat itself. Those who desire a more accurate pronunciation of the written name must learn it on the spot by a study of local accent and peculiarities.

5. The broad features of the system are: (*a*) That vowels are pronounced as in Italian and consonants as in English. (*b*) Every letter is pronounced, and no redundant letters are introduced. When two vowels come together each one is sounded, though the result, when spoken quickly, is sometimes scarcely to be distinguished from a single sound, as in *ai*, *au*, *ei*. (*c*) One accent only is used, the acute, to denote the syllable on which stress is laid. This is very important, as the sounds of many names are entirely altered by the misplacement of this "stress."

6. Indian names are accepted as spelt in Hunter's "Gazetteer of India," 1881.

ELECTRICITY IN AGRICULTURE.[1]

FROM the time electricity became a science much research has been made to determine its effect, if any, upon plant growth. The earlier investigations gave, in many cases, contradictory results. Whether this was due to a lack of knowledge of the science on the part of the one performing the experiments, or some defect in the technical applications, we are not prepared to say; but this we do know, that such men as Jolabert, Nollet, Mainbray, and other eminent physicists affirmed that electricity favored the germination of seeds and accelerated the growth of plants, while on the other hand Ingenhouse, Sylvestre, and other savants denied the existence of this electric influence. The heated controversies and animated discussions attending the opposing theories stimulated more careful and thorough investigations, which established beyond a doubt that electricity had a beneficial effect on vegetation Sir Humphrey Davy, Humboldt, Wollaston, and Becquerel occupied themselves with the theoretical side of the question; but it was not till after 1845 that practical electro-culture was undertaken. Williamson suggested the use of gigantic electro-static machines, but the attempts were fruitless. The methods most generally adopted in experiments consisted of two metallic plates — one of copper and one of zinc — placed in the soil and connected by a wire. Sheppard employed the method in England in 1846, and Foster used the same in Scotland. In the year 1847 Hubeck in Germany surrounded a field with a network of wires. Sheppard's experiments showed that electricity increased the return from root crops, while grass perished near the electrodes, and plants developed without the use of electricity were inferior to those grown under its influence. Hubeck came to the conclusion that seeds germinated more rapidly and buckwheat gave larger returns; in all other cases the electric current produced no result. Professor Fife in England and Otto von Ende in Germany carried on experiments at the same time, but with negative results, and these scientists advised the complete abandonment of applying electricity to agriculture. After some years had elapsed Fichtner began a series of experiments in the same direction. He employed a battery, the two wires of which were placed in the soil parallel to each other. Between the wires were planted peas, grass, and barley, and in every case the crop showed an increase of from thirteen to twenty-seven per cent when compared with ordinary methods of cultivation.

Fischer of Waldheim, believing atmospheric electricity to aid much in the growth and development of plants, made the following tests: —

He placed metallic supports to the number of about sixty around each hectare (2.47 acres) of loam; these supports were provided

[1] Abstract of the January Bulletin of the Hatch Experiment Station, Amherst, Mass., written by Clarence D. Warner.

at their summit with electrical accumulators in the form of crowns surmounted with teeth; these collectors were united by metallic connection. The result of this culture applied to cereals was to increase the crop by half.

The following experiment was also tried: Metallic plates sixty-five centimetres by forty centimeters were placed in the soil. These plates were alternately of zinc and copper and placed about thirty metres apart, connected two and two, by a wire. The result was to increase from twofold to fourfold the production of certain garden plants. Mr. Fischer says, that it is evidently proved that electricity aids in the more complete breaking up of the soil constituents. Finally, he says that plants thus treated mature more quickly, are almost always perfectly healthy, and not affected with fungoid growth.

Later, N. Specnew, inspired by the results arrived at by his predecessors, was led to investigate the influence of electricity on plants in every stage of their development; the results of his experiments were most satisfactory and of practical interest. He began by submitting different seeds to the action of an electric current and found that their development was rendered more rapid and complete. He experimented with the seeds of haricot beans, sunflowers, winter and spring rye. Two lots of twelve groups, of one hundred and twenty seeds each, were plunged into water until they swelled, and while wet the seeds were introduced into long glass cylinders, open at both ends. Copper discs were pressed against the seeds, the discs were connected with the poles of an induction coil, the current was kept on for one or two minutes, and immediately afterwards the seeds were sown. The temperature was kept from 45° to 50° Fahrenheit, and the experiments repeated four times. The following table shows the results: —

	Peas. Days.	Beans. Days.	Barley. Days.	Sunflowers. Days.
Electrified seeds developed in..........	2.5	3	·2	8.5
Non-electrified seeds developed in......	4	6	5	15

It was also observed that the plants coming from electrified seeds were better developed, their leaves were much larger and their color much brighter than in those plants growing from non-electrified seeds. The current did not affect the yield.

At the Botanical Gardens at Kew, the following experiment was tried: —

Large plates of zinc and copper (.445 of a meter and .712 of a meter) were placed in the soil and connected by wires, so arranged that the current passed through the ground; the arrangement was really a battery of (zinc | earth | copper). This method was applied to pot herbs and flowering plants and also to the growing of garden produce; in the latter case the result was a large crop and the vegetables grown were of enormous size.

Extensive experiments in electro-culture were also made at Pskov, Russia. Plots of earth were sown to rye, corn, oats, barley, peas, clover, and flax; around these respective plots were placed insulating rods, on the top of which were crown shaped collectors — the latter connected by means of wires. Atmospheric electricity was thus collected above the seeds and the latter matured in a highly electrified atmosphere; the plots were submitted to identical conditions, and the experiments were carried on for five years. The results showed a considerable increase in the yield of seed and straw, the ripening was more rapid, and the barley ripened nearly two weeks earlier with electro-culture. Potatoes grown by the latter method were seldom diseased, only 0 to 5 per cent against 10 to 40 per cent by ordinary culture.

Grandeau, at the School of Forestry at Nancy, found by experiment that the electrical tension always existing between the upper air and soil stimulated growth. He found plants protected from the influence were less vigorous than those subject to it.

Macagno, also believing that the passage of electricity from air through the vine to earth would stimulate growth, selected a certain number of vines, all of the same variety and all in the same condition of health and development. Sixteen vines were submitted to experiment and sixteen were left to natural influences. In the ends of the vines under treatment, pointed platinum wires were inserted, to which were attached copper wires, leading to the tops of tall poles near the vines; at the base of these same vines other platinum wires were inserted and connected by copper wires with the soil. At the close of the experiment, which began April 15, and lasted till September 16, the wood, leaves, and fruit of both sets of vines were submitted to careful analysis, with the following results:

	Without conductor.	With conductor.
Moisture per cent..............	78.21	79.84
Sugar...........................	16.86	18.41
Tartaric acid	0.880	0.791
Bitartrate of potash............	0.180	0.186

Thus we see that the percentage of moisture and sugar is greater and the undesirable acid lower in those vines subject to electrical influence than in those left to natural conditions. There are also experiments which prove the beneficial effects of electricity on vines attacked by Phylloxera.

The following experiments were made at this station: Several plots were prepared in the greenhouse, all of which had the same kind of soil and were subjected to like influences and conditions. Frames in the form of a parallelogram, about three feet by two feet, were put together; across the narrow way were run copper wires in series of from four to nine strands, each series separated by a space about four inches wide, and the strands by a space of one-half an inch. These frames were buried in the soil of the plot at a little depth, so that the roots of the garden plants set would come in contact with the wires, the supposition being that the currents of electricity passing along the wires would decompose into its constituents the plant food in the vicinity of the roots and more readily prepare it for the plants. The electric gardens were thus prepared and each furnished with two common battery cells, so arranged as to allow continuous currents to pass through each series of wires. Near each electric garden was a plot prepared in the same manner, save the electrical apparatus. We will call the two gardens A. and B.

The place chosen for the experiments was in a part of the greenhouse which is given up largely to the raising of lettuce, and the gardens were located where much trouble from mildew had been experienced. The reason for this choice of location was to notice, if any, the effect of electricity upon mildew, this disease being, as is well known, a source of much trouble to those who desire to grow early lettuce. The soil was carefully prepared, the material taken from a pile of loam commonly used in the plant house.

Garden A was located where mildew had been the most detrimental; the experiments began the first of January and closed the first of April. For the garden, fifteen lettuce plants of the head variety were selected, all of the same size and of the same degree of vitality, as nearly as could be determined; the plants were set directly over the wires, so that the roots were in contact with the latter; the plants were well watered and cared for as in ordinary culture, and the fluid in the battery cells was renewed from time to time, that the current of electricity might not become too feeble. At the close of the experiments the following results were noted.

Five plants died from mildew, the others were well developed and the heads large. The largest heads were over the greatest number of wires and nearest the electrodes. It was further noticed that the healthiest and largest plants, as soon as the current became feeble or ceased altogether, began to be affected with mildew. On examining the roots of the plants it was found that they had grown about the wires, as if there they found the greatest amount of nourishment; the roots were healthy and in no way appeared to have been injured by the current, but, rather, much benefited by the electrical influences.

Beside garden A was prepared another plot of the same dimensions, having the same kind of soil and treated in like manner as the first, but the electrical apparatus and wires were wanting. At the close of the experiments only three plants had partially developed, and two of these were nearly destroyed by mildew — one only was free from the disease. The results, therefore, show that the healthiest and largest plants grew in the electric plot.

In the second experiment, which we called B, twenty plants of the same variety of lettuce and of equal size were taken. The treatment given was the same as the plants in plot A received. Five plants only remained unaffected with mildew; seven died from the disease when they were half grown; the rest were quite well developed, but at the last part of the experiment began to be affected. Several heads were large, the largest being over the greatest number of wires and nearest the electrodes. Examination of the roots disclosed the same phenomena as in A.

Near plot B were also set twenty other plants, subjected to like conditions as the first, but without electricity; all but one died from mildew before they were half grown, the solitary plant that survived being only partly developed at the close of the experiment, and even this was badly affected with the desease.

Everything considered, the results were in favor of electricity. Those plants subjected to the greatest electrical influence were hardier, healthier, larger, had a better color and were much less affected by mildew than the others. Experiments were made with various grasses, but no marked results were obtained.

The question would naturally arise whether there may not be a limit reached where electricity would completely overcome the attack of mildew and stimulate the plant to a healthy and vigorous condition throughout its entire growth. From the fact that the hardiest, healthiest, and largest heads of lettuce grew over the greatest number of currents and nearest the electrodes, it would seem that electricity is one of the agents employed by nature to aid in supplying the plant with nourishment and to stimulate its growth. To what extent plants may be submitted to electrical influence, or what strength of current is best suited to them and what currents prove detrimental to their development, have not been determined as yet, but it is desirable to continue this research until some definite information shall be gained on these points. Probably different varieties of plants differ greatly in their capacity for enduring the action of electric currents without injury — experiment alone must determine this.

It has been proved that the slow discharge of static electricity facilitates the assimilation of nitrogen by plants. Faraday showed that plants grown in metallic cages, around which circulated electric currents, contained fifty per cent less organic matter than plants grown in the open air. It would seem from the researches of the latter physicist, that those plants requiring a large percentage of nitrogen for their development would be remarkably benefited if grown under electric influence.

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.*

On request in advance, one hundred copies of the number containing his communication will be furnished free to any correspondent.

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

The First Locomotive Run in America.

IT was in 1829, the same year in which Stephenson, with his "Rocket," demonstrated the practicability of rapid steam traction on railways. The engine was named the Stonebridge Lion. It was made in England and imported by the Delaware and Hudson Canal Company, and designed to draw coal from their mines in Carbondale to the head of their canal in Honesdale, Penn. On its arrival, it was placed on the railway and run from Honesdale to Seeleyville, a little over a mile. It was found to be too tall to go under a highway bridge over the track at that place, and was reversed and run back to Honesdale. All parts of the railway above the surface of the ground were built on trestles, and the heavy engine racked them so much as to endanger safety. For these reasons the locomotive was set off by the side of the track, and a board shed built over it. The railway was planked, and horses employed to draw the cars. The engine stood there safe for several years.

The writer was personally acquainted with these facts. Two men who rode on that trip are living at this time.

In 1840 and 1841, while I was a student in the Honesdale Academy, I found the boards on one side of the shed torn off and the engine exposed to view. I spent many hours in trying to study out its mechanism and movement. No published description of a steam-engine was then within my reach. The Stonebridge Lion had four wheels, three or three and a half feet in diameter, and the boiler rested directly on the axles. The cylinders were vertical, one on each side of the boiler near the hind wheels. There were two heavy iron walking-beams a few feet above the boiler, and to one end of each a piston-rod was attached by Watt's parallelogram. The other ends of the beams were joined by swinging-rods to cranks at right angles to each other on the forward wheels. There was no whistle or bell, I think. The engineer stood on a small open platform behind the boiler.

Soon after 1841 the engine began to be carried off piece by piece, mostly by blacksmiths and machinists; and I am told that only one small piece of the iron is now in existence in its primitive form. If the engine had been kept intact, it would be worth almost its weight in silver for exhibition in Chicago in 1893.

M. H.

The Historical American Exhibition at Madrid.[1]

ONE of the most interesting and instructive celebrations proposed for the year 1892 is the Spanish celebration, the chief feature of which will be an exhibition at Madrid, termed the Historical American Exhibition, the special object of which is to illustrate primitive American life and the history of the period of discovery and conquest. In selecting the prehistoric and early historic eras for illustration, the Spaniards will make their own exhibition complete in itself, without in the least competing with the Chicago exhibition.

The plan of the exhibition is, within its limits, a very broad one, comprising five general divisions, viz., prehistoric America, the historic period, Indian industrial arts, cartography, nautical instruments, etc., and the fine arts and kindred subjects. Under the head of prehistoric America, plans, models, reproductions, drawings, etc., are solicited of ancient caves and caverns, and anything that may help to show the use of these primitive places as human dwellings. Similar models, drawings, or photographs are desired of American menhirs, dolmens, and mounds, as well as lacustrine dwellings. All sorts of implements and objects relating to this period are desired, such as stone weapons, articles of bone and horn, pottery, ornaments, utensils of bone, wood, stone, and other materials, with fossil or animal bones throwing light on the archæology of this time. Examples of all the ages and periods of primitive life as they can be traced on the American continent are wanted.

In the historic period the objects desired include models of ancient American buildings, architectural remains, plans, models, and drawings of restored monuments. Examples of sculpture, bas-reliefs, architectural paintings, and other forms of painted decoration form another class. Under industrial art is included clothing and adornment of the aborigines and uncivilized Indians, with implements of war, offensive and defensive. Jewels of gold, silver, bone and ivory, pottery, household utensils, and articles used in transportation by water and land, constitute another division of this branch, while written documents in native tongues, pictures, and photographs of Indians and effigies showing native costumes, models of Indian dwellings, and Indian crania, form a third division.

The department of cartography includes maps, plans, charts, and drawings, and all that concerns ancient cartography, with models of vessels anterior to the voyage of Columbus, as well as those he himself used. A section is devoted to nautical instruments, with the idea of illustrating the instruments, charts, and maps in use at the period of discovery, while objects in personal use by Columbus and pictures of the same are also desired. The fine arts department includes ancient architectural monuments, sculpture, paintings, industrial and artistic work following the discovery, American coins, literary and scientific publications, manuscripts, charts, and plans of all kinds, from the discovery to the middle of the eighteenth century.

Most liberal inducements are offered to intending exhibitors from America. The exhibition will be held in the new library and national museum building in the park at Madrid, which will be used for the first time for this purpose, the exhibition serving as a sort of inauguration of the structure, which has been a num-

[1] This letter appeared also in The Nation.

ber of years in building. It will be opened on Sept. 12, 1892, and will close on Dec. 31 of the same year, thus preceding the Chicago exhibition, which it is designed, in a measure, to supplement. All objects, if securely and properly packed, will be forwarded gratis to Madrid, and returned to the exhibitor free of expense, the exhibition not only bearing the cost of transportion, but also, when desired, attending to the arrangement and display of the objects without any charge. Those who desire special cases of their own may provide them, and special buildings may also be erected in the park if the design is approved by the general committee. All objects for the exhibition will be admitted duty free into Spain if they are withdrawn at the close of the exhibition, but two months will be allowed after the end of the exhibition before articles need be returned.

An international jury, proportionate to the number of the exhibitors from different countries and the importance of their exhibits, will examine the articles displayed and award the prizes. These will consist of a first prize of honor, a gold medal, a silver medal, a bronze medal, and honorable mention, each medal being accompanied with a diploma.

The exhibition covers, of course, the entire American continent, but to insure its complete success the active co-operation and assistance of citizens of the United States is especially desired. There is every reason why Americans should both be interested in this exhibition and take part in it. The conditions are liberal, the prizes ample, and the time is especially convenient to intending exhibitors at the Chicago exhibition, as objects may be exhibited both at Madrid and at Chicago. Nor is the novelty of the exhibition its least merit. Early American history has always been a favorite topic of study among European scholars, but it is safe to say that if this exhibition is carried out as it is planned, it will offer Europeans the first opportunity they have had to study primitive American life in its completeness. American collections are very rich in the materials most desired at Madrid, and it is most sincerely to be hoped that the gracious invitation of the Spanish people to participate in their Columbian celebration will meet with a generous and hearty support from American scholars and collectors. BARR FERREE.

New York.

At What Time were the Galapagos Islands Discovered?

I SHOULD be greatly obliged to anyone who could give me some information in regard to the discovery of the Galapagos Islands. The first notice I have been able to find is in the Atlas of Abraham Ortelius, published in 1570, where the Islands are spelled "Galopegos" and "Galepegos" (Ortelius, Abraham, "Typus Orbis Terrarum," 1570; second edition, 1580; "Theatrum oder Schaubuch des Erdkreys, Autdorff, Americae sive novi orbis novae descriptio," 1570). On the splendid map of Diego Ribero, prepared between 1527 and 1529, the Galapagos Islands are not represented (Ribero, Diego, J. G. Kohl, "Die beiden aeltesten General Karten von America ausgeführt in den Jahren, 1527 and 1529, auf Befehl Kaiser Carl's, v.," Weimar, 1860). It seems therefore probable that these islands were discovered in the beginning of the sixteenth century, before 1570. The word *galapago* itself seems to be of South American origin; it means land-tortoise G. BAUR.

Clark University, Worcester, Mass., Jan. 10.

BOOK-REVIEWS.

School and College; devoted to secondary and higher education. Edited by Ray Greene Huling. Vol. I., No. 1, January, 1892. Boston, Ginn & Co.

MAGAZINES and newspapers devoted to educational subjects multiply apace, so that if our teachers are not properly informed on matters relating to their work, it will not be for want of the means of intercommunication. This latest comer in the field is a magazine of sixty-four pages, to be issued every month except July and August, at twenty cents a number, or $1.50 a year. The articles in this opening number show very plainly the influence of the educational ideas just now prevalent; indeed, they may be said to show little else. The writers appear to agree that the study of Greek is destined to be abandoned; though the editor speaks of this as an event that is inevitable rather than as one to be desired. The most interesting paper in the magazine is that by President Andrews of Brown University on "Some of the Next Steps Forward in Education," its most important point being the suggestion that teachers ought to enter into closer moral and social relations with their pupils. Mr. B. C. Burt has an article advocating the beginning of philosophical study at an earlier age than is now customary; but unless the subject can be made more easily intelligible than it is in his article, we fear that his wishes will not be realized. Mr. John Tetlow gives an account of "The Greek Method of Performing Arithmetical Operations," which will be of interest to mathematical students; and Mr. James H. Blodgett has a brief paper on "Secondary Education in Census Years." The rest of the magazine is occupied with educational news, both domestic and foreign, a few book reviews of no great value, and several brief "Letters to the Editor." The new magazine has some good points, and its field, though narrow, may be made interesting by proper cultivation; but it seems to us that an improvement in the quality of our educational literature is more important than an increase in its quantity.

Geological Survey of Alabama. EUGENE ALLEN SMITH, Ph.D., State Geologist. Report on the Coal Measures of the Plateau Region of Alabama, by Henry McCalley, Assistant State Geologist, including a report on the Coal Measures of Blount County, by A. M. Gibson, with a Map of the Coal-Fields and two Colored Geological Sections across the Plateau Region and Intermediate Valleys. Montgomery, Ala., 1891.

IN the Report of Progress of the Alabama Geological Survey, for the years 1877–8, the division of the Warrior Coal-Field into "Plateau Region" and "Warrior Basin" was first made by Dr. Smith, the State geologist. Characteristic of the Plateau Region is the circumstance that the limestone beds which underlie the capping of Coal Measures are above the general drainage level of the country. This arrangement of the two classes of strata determines in great measure the character of the scenery, for the removal by erosion of the more perishable limestone causes the undermining of the harder strata above, which from time to time break off with nearly vertical faces, forming cliffs which overlook all the valleys. The three principal valleys that traverse this region, in a north-east and south-west direction, are anticlinal valleys, more or less complicated by faulting and overlapping; they are Wills's, Murphree's, and Brown's Valleys, the latter being an extension into this State of the great Sequatchee Valley of Tennessee. Between these anticlinals the Coal Measures occupy shallow synclinal troughs, which also show secondary undulations, with axes nearly at a right angle to the axes of the synclinals and anticlinals, i.e., approximately north-west and south-east. In the anticlinal valleys strata down to the Cambrian are exposed, but in the smaller valleys, cut by streams in the synclinal troughs, only the subcarboniferous measures are reached by the erosion.

Towards the south-west the Coal Measures and their underlying strata slope gradually and more rapidly than the topography, and the Plateau Region thus grades insensibly into the Basin, where none of the beds underlying the coal are above drainage. In the Plateau Region, and particularly in its north-eastern portion, only the lowest of the rocks of the Coal Measures are left capping the mountains, viz., the two conglomerates with their intervening and underlying beds; but further towards the south-west, other higher members of the Coal Measures come in and the plateau like character is in equal measure lost.

The Report for 1877–8, above referred to, and a subsequent Report for 1879–80, contained notes chiefly on the Coal Measures of the Warrior Basin. In 1886 a large volume from the pen of Mr. McCalley, "On the Warrior Field," was published by the survey. This report also was concerned chiefly with the Measures of the Warrior Basin, though containing some notes on part of the Plateau Region. The present volume deals with the Measures of the Plateau Region alone, and presents about all the information at this time available. The two colored sections exhibit well the geological and topograhic features of this region, and show the gradual sinking of the strata towards the south-west and the passage into the Basin proper.

The two conglomerates named above are identical with the Upper and Lower Conglomerates of Professor Safford of Tennessee. They are usually some twenty-five to thirty feet apart, though sometimes separated by a hundred and fifty feet of other strata, and sometimes in direct contact with each other. The lower conglomerate is usually the harder of the two, and is often called the "Mill-stone Grit." In the north-eastern part of the region the most important coal-bearing beds are below this lower conglomerate, and have an average thickness of fifty feet, but there are places where the sub-conglomerate measures have a thickness of seven hundred feet or more, as in parts of Blount County.

The principal seam of coal in the sub conglomerate measures is the Cliff Seam, immediately under the lower conglomerate or cliff rock. Its thickness, like that of all these lower coal seams, is extremely variable, ranging from a few inches to five or six feet. Fifteen or twenty feet below the Cliff Seam is the Dade or Eureka Seam, likewise very variable in thickness, passing, within limited areas, from a few inches to twelve or fourteen feet. This great variability in the thickness seems generally to be due to undulations in the strata forming the floor of the beds, though in some cases to variations in the roof or cover. While there are two or three other seams below these, the two just named have furnished most of the coal mined in the plateau region, and of this the Cliff Seam has yielded the greater part. Between the two conglomerates there is another good workable seam, the Sewanee Seam, from two to three feet in thickness.

While the upper conglomerate forms generally the surface rock over the Plateau Region, there are in many places, and especially as we go south westward, overlying strata with their coal seams, none of which, however, have been worked in this section, but which become more and more important in the direction of the Basin above mentioned, and yielding all the coal there mined. In that direction also the sub-conglomerate coals lose their importance, being mined nowhere in Alabama except in the north-eastern portion of the Plateau Region in Madison, Jackson, and DeKalb Counties.

In these lower Coal Measures there are, very generally, beds of clay iron-stone (carbonate), and of black band, which may some day come into use.

Homilies of Science. By DR. PAUL CARUS. Chicago, Open Court Pub. Co. 12°. $1.50.

THIS book consists of articles on various topics in science, religion, and morals, contributed at intervals to the *Open Court* newspaper, of which Dr. Carus is editor. He tells us in his preface that in early life he intended to be a preacher in the Christian church; his inclination toward the religious life being partly due to his native disposition, and partly, no doubt, to the example of his father, who was a doctor of theology and an officer in the church of eastern and western Prussia. But his studies led him, as they have led many others in our time, to doubt the truth of many of the Christian doctrines, and ultimately to complete religious and philosophical scepticism. He therefore abandoned his intention of entering the church, and after a time became a preacher of the new doctrines that he had adopted, the most conspicuous of which is a blank materialism — a materialism which is not in the least disguised by calling it "monism." But while abandoning all distinctly religious views, Dr. Carus has held fast to the supremacy of the moral law and the need of moral improvement in personal and social life, and the earnestness with which he preaches these truths constitutes the main interest of this book. His remarks on God and immortality will be far indeed from pleasing religious minds; but what he says on ethical subjects, though containing nothing particularly new, will find an echo in the hearts of good men of every creed. He is wholly uninfected with the socialistic heresies now so widely prevalent, and he sternly rebukes those free-thinkers who regard morality with indifference, and scoff at its requirements.

In all that he says about the need of moral improvement and the dignity of man's moral nature, it is needless to say that we cordially agree with him; but we are by no means prepared to follow him in his rejection of all religious belief. We do not believe that the world will abandon theism, though it will undoubtedly abandon many of the traditional dogmas of Christianity, if it has not already abandoned them. Nor can we agree with Dr. Carus in thinking that the views set forth in his book are the last word of science and philosophy on religious themes. On the contrary, we regard the present as emphatically an age of transition in religion and philosophy; and we believe that the religion of the future will be quite different from the doctrine of Dr. Carus, widely prevalent as his views undoubtedly are at the present time. But as an example of existing tendencies, as well as by its moral earnestness, this book will interest the reader.

AMONG THE PUBLISHERS.

IN *St. Nicholas* for January Eliza Ruhamah Scidmore, favorably known as a writer on Japanese subjects, tells of "Two Queer Cousins of the Crab" — the giant crab and the little mask-crab that carries the impress of a human face upon its shell.

— John Wiley & Sons have in preparation a work by Simpson Bolland, entitled "The Iron Founder."

— "It would be a wise and timely move," says *Outing* for January, "to prohibit the sale of grouse of all kinds and quail for, say, a period of at least three years. This would give a fair idea of just how much the market-shooters are responsible for the decrease of our game, and should so lessen the annual slaughter as to give the birds every chance to increase."

— Charles Scribner's Sons have now ready "The Real Japan," studies of contemporary Japanese manners, morals, administration, and politics, by Henry Norman, with seventy illustrations from photographs taken by the author; also "The Development of Navies During the Last Half Century," by Captain Eardley-Wilmot, which forms a volume in the Events of Our Own Time Series.

— Macmillan & Co. will publish in the course of January Mr. Henry Jephson's account of the "Rise and Progress of the Political Platform." The work is in two volumes, of which the first deals with the long struggle for the rights of public meeting and of free speech during the reigns of George III. and George IV. The second volume follows the progress of the platform from the agitation for the first reform bill to that which preceded the reform act of 1884. Mr. Jephson finally treats of the position and power of the platform in the present day.

— A unique experiment will be tried in the February issue of *The Ladies' Home Journal.* The entire number has been contributed in prose, fiction, and verse by the daughters of famous parentage, as a proof that genius is often hereditary. The work of thirty of these "daughters" will be represented. These will comprise the daughters of Thackeray, Hawthorne, Dickens, James Fenimore Cooper, Horace Greeley, Mr. Gladstone, President Harrison, William Dean Howells, Senator Ingalls, Dean Bradley of Westminster, Julia Ward Howe, General Sherman, Jefferson Davis, and nearly a score of others. Each article, poem, or story printed in this number has been especially written for it, and the whole promises to be a successful result of an idea never before attempted in a magazine.

— The *Quarterly Journal of Economics* for January contains an important article by Hon. Carroll D. Wright on the "Evolution of Wages Statistics," showing the gradual process by which the statistics of labor have been perfected in the last twenty years, the United States leading the way. S. M. Macvane writes on "Capital and Interest," and H. Bilgram of Philadelphia on "Böhm-Bawerk's Positive Theory of Capital." J. A. Hill makes a careful study of the recent "Prussian Income Tax," and W. B. Shaw presents his annual review of "Social and Economic Legislation by the States in 1891." Various notes and memoranda and the usual careful bibliography for the preceding quarter make up a number having great variety of contents and of interest.

— *The Chautauquan* for February presents the following table of contents: The Battle of Monmouth, by John G. Nicolay; Domestic and Social Life of the Colonists, V., by Edward Everett Hale; Trading Companies, II., by John H. Finley; States made from Territories, II., by Professor James Albert Woodburn; Sunday Readings, selected by Bishop Vincent; Physical Culture, I., by J. M. Buckley, LL.D.; National Agencies for Scientific Research, by Major J. W. Powell, Ph.D., LL.D.; The Bureau of Animal Industry, by George W. Hill; Highbinders, by Frederic J. Masters; Our Ships on the Lakes and Seas, by Samuel A. Wood; The Present Position of German Politics, by George Wheeler Hinman, Ph.D.; Spain, Cnba, and the United States, by Rollo Ogden; How a Bill Presented in Congress Beeomes a Law, by George Harold Walker; The Balkan States and Greece; Strawberry Hill, by Eugene L. Didier; The Woman's Congress, by Isabel Howland; Legal Domestic Relations, by Mary A. Greene, LL.B.; Making and Testing Flour, by Emma P. Ewing; Opportunities for Women in Washington, D.C., by Mrs. Emily L. Sherwood; Daughters of the Fatherland, by Miss E. S. Braine; How to Restore Health, by Hermine Welten; What Next in Women's Societies? by Margaret W. Noble; Seawomen, by Margaret B. Wright. The editorials treat of The Ethics of Story Telling, Republican South America, and How to Live with Others. There are the usual departments devoted to the Chautauqua Literary and Scientific Circle.

— P. Blakiston, Son, & Co., Philadelphia, have nearly ready a reprint of Gower's (W.R.) "Manual of Nervous Diseases," second edition, issued here by special arrangement with the author. They have just published Greig Smith's "Abdominal Surgery," fourth edition; Muskett's "Prescribing and Treatment in Diseases of Children;" Blair's "The Organic Analysis of Potable Waters," second edition; and will issue very shortly "A Manual of Autopsies," by Dr. Isaac Blackburn, a revised edition of Naphey's "Therapeutics," and a volume on "Diseases of the Throat, Nose, and Ear," containing a large number of colored wood engravings printed with the text, by E P. McBride, F.R.C.P., Edinburgh.

— Ginn & Co. announce "Outline of Lessons in Botany, for the Use of Teachers, or Mothers studying with Their Children," by Jane H. Newell, Part II.: "Flower and Fruit." The course begins early in March with the crocuses and other early bulbous plants, and continues with lessons on some common house-plants, in order that the pupil may be familiar with the ordinary botanical terms before taking up the spring wild-flowers. Spring flowers are then studied, in the order of their blooming, together with the forest trees, the blossoming fruit-trees, and some of our common weeds. These studies are not analytic only, but deal with the life-habits of the plants, their adaptations for fertilization, dissemination, and protection. Lessons on the stamens, the pistil, inflorescence, the fruit, and other topics are given in connection with the flower studies. The book aims to encourage habits of correct observation, and suggests points for the class to investigate. The book will be found valuable to persons studying by themselves, as it contains copious references to the literature of the subject, as well as original studies. The book contains a classification chart including sixty families.

CALENDAR OF SOCIETIES.

Women's Anthropological Society of America, Washington.

Jan. 9.—Alice C. Fletcher, A Talk on Folk Lore.

Publications received at Editor's Office.

CARUS, DR. PAUL. Homilies of Science. Chicago, Open Court Pub. Co. 12°. 327 p. $1.50.
CHAMBERS'S ENCYCLOPAEDIA. New edition. Vol. viii. Peasant to Roumelia. Philadelphia, Lippincott. Royal 8°. 828 p. $3.
EARDLEY-WILMOT, CAPT. S. The Development of Navies during the last half-century. New York, Scribner. 12°. 311 p. $1.75.
HART, ALBERT BUSHNELL. Epoch Maps, Illustrating American History. New York, Longmans. 8°. Paper. 50 cents.
HELEN KELLER. Souvenir of the first summer meeting of the American Association to Promote the Teaching of Speech to the Deaf. Washington, Volta Bureau. 4°. 16 p.
HOPKINS, G. IRVING. Manual of Plane Geometry on the Hevristic Plan. Boston, D. C. Heath & Co. 187 p. 12°. 75 cents.
HUIDEKOPER, RUSH SHIPPEN. Age of the Domestic Animals. Philadelphia, F. A. Davis. 8°. 225 p. $1.75.
HUNT, THOMAS STERRY. Systematic Mineralogy. New York, The Scientific Pub. Co. 8°. 409 p.
MASTERPIECES OF AMERICAN LITERATURE. Boston, Houghton, Mifflin & Co. 12°. 470 p.
MAYCOCK, W. PERREN. A First Book of Electricity and Magnetism. London, Whittaker & Co. 16°. 147 p. 60 cents.
MINERALS: a monthly magazine. Vol. i. No. 1. New York, The Goldthwaites. 8°. Paper. 30 p. $1 per year. 10 cents a copy.
NEW YORK STATE REFORMATORY. Sixteenth Year-Book, containing the annual report of the Board of Managers for the year ending Sept. 30, 1891. Elmira, N. Y. S. Reformatory Press. 8°. Paper.
NISSEN, HARTVIG. A B C of the Swedish System of Educational Gymnastics. Philadelphia, F. A. Davis. 12°. 116 p. 75 cents.
OHM, G. S. The Galvanic Circuit Investigated Mathematically. Trans. by William Francis. New York, Van Nostrand Co. 18°. 269 p. 50 cents.
POWELL, J. W. Tenth Annual Report of the U. S. Geological Survey, 1888-89. Part i., Geology. Part ii., Irrigation. Washington, Government. 2 vols. 4°. pp. 792, 131.
SCHOOL AND COLLEGE: devoted to secondary and higher education. Edited by Ray Greene Huling. Vol. i. No. i. Jan., 1892. Boston, Ginn & Co. 8°. Paper. 64 p. $1.50 a year; 20 cents a number.
SCOTT, ALEXANDER. An Introduction to Chemical Theory. Edinburgh, A. J. C. Black. 12°. 274 p. $1.25.
SEXTON, SAMUEL. Deafness and Discharge from the Ear. New York, J. H. Vail & Co. 12°. 89 p.
THE PHILOSOPHICAL REVIEW: bi-monthly. Edited by J. G. Schurman. Vol. i. No. i. Jan., 1892. Boston, Ginn & Co. 8°. Paper. 128 p. $3 a year; 75 cents a number.
WILD, H. Aunalen des Physikalischen Central-Observatoriums. Jahrgang, 1890. Theil i. St. Petersburg, Kaiserlichen Akademie der Wissenschaften. 4°. Paper.

Wants.

Any person seeking a position for which he is qualified by his scientific attainments, or any person seeking some one to fill a position of this character, be it that of a teacher of science, chemist, draughtsman, or what not, may have the 'Want' inserted under this head FREE OF COST, *if he satisfies the publisher of the suitable character of his application. Any person seeking information on any scientific question, the address of any scientific man, or who can in any way use this column for a purpose consonant with the nature of the paper, is cordially invited to do so.*

WANTED.—(1) A white man versed in wood and iron working, able to work from specifications and plans, suited for an instructor of boys; his business to have charge of shops of school, outline and direct the work for foremen and students; salary to be $1,000 per annum (nine months). (2) A man (black preferred) to teach the colored, iron working and forging, subordinate to the preceding; salary, $720. (3) A man (white) competent to take classes in engineering (assistant's position), but with the ability to perform any of the work required in any of the ordinary engineering courses of our universities; salary from $1,000 to $1,500. A. H. BEALS, Milledgeville, Ga.

WANTED.—Two or three efficient computers with good knowledge of Spherical Trigonometry and ready use of logarithms, for temporary employment in the office of the Coast and Geodetic Survey. Applicants should furnish evidence of their fitness for the work. Apply by letter to the Superintendent, Coast and Geodetic Survey, Washington, D.C.

WANTED.—*Science*, No. 178, July 2, 1886, also Index and Title-page to Vol. VII. Address N. D. C. Hodges, 874 Broadway, New York.

A YOUNG MAN (31) would like a position in a college, laboratory, or observatory, is also willing to assist at a steam engine, etc. Address J. W., care of *Science*, 874 Broadway, New York.

WANTED.—A position in the philosophical or pedagogical department of a college or university by a young man (30) who has had five years' practical experience in teaching, and who has done four years' post-graduate work in philosophy, devoting his attention during the last two years especially to study and original investigation in scientific psychology and its applications in education. Address E. A., care *Science*, 874 Broadway, N. Y. City.

WANTED.—A suitable position in Washington, D. C., not connected with the Government, and with a salary not to exceed $650 a year, by an experienced biologist with six years' university training. Applicant has been a skilful surgeon for fourteen years; is a practical photographer, cartographer, and accustomed to the use of the typewriter. He is also capable of making the most finished drawings, of any description, for all manner of illustrative purposes in science; trained in museum methods and work; also field operations and taxidermy in its various departments, and modeling, production of casts, restorations of paleontological specimens and similar employments. Address U. S. R., care *Science*, 47 Lafayette Place, N. Y.

Exchanges.

[Free of charge to all, if of satisfactory character. Address N. D. C. Hodges, 874 Broadway, New York.]

Wanted to buy or exchange a copy of Holbrook's North American Herpetology, by John Edwards. 5 vols. Philadelphia, 1842. G. BAUR, Clark University, Worcester, Mass.

For sale or exchange, LeConte, "Geology;" Quain, "Anatomy," 2 vols.; Foster, "Physiology," Eng. edition; Shepard, Appleton, Elliott, and Stern, "Chemistry;" Jordan, "Manual of Vertebrates;" "International Scientists' Directory;" Vol. I. *Journal of Morphology;* Balfour, "Embryology," 2 vols.; Leidy, "Rhizopods;" *Science*, 18 vols., unbound. C. T. McCLINTOCK, Lexington, Ky.

For sale.—A 6½ x 8½ Camera; a very fine instrument, with lens, holders and tripod, all new; it cost over $40; price, $25. Edw. L. Hayes, 6 Athens street, Cambridge, Mass.

To exchange Wright's "Ice Age in North America" and Le Conte's "Elements of Geology" (Copyright 1882) for "Darwinism," by A. R. Wallace, "Origin of Species," by Darwin, "Descent of Man," by Darwin, "Man's Place in Nature," Huxley, "Mental Evolution in Animals," by Romanes, "Pre-Adamites," by Winchell. No books wanted except latest editions, and books in good condition. C. S. Brown, Jr., Vanderbilt University, Nashville, Tenn.

For Sale or Exchange for books a complete private chemical laboratory outfit. Includes large Becker balance (200g. to 1-10mg.), platinum dishes and crucibles, agate motors, glass-blowing apparatus, etc. For sale in part or whole. Also complete file of *Silliman's Journal*, 1862-1885 (62-71 bound); Smithsonian Reports, 1854-1883; U. S. Coast Survey, 1854-1869. Full particulars to enquirers. F. GARDINER, JR., Pomfret, Conn.

For exchange or sale at a sacrifice, an elaborate microscope outfit. Bullock stand; monocular objectives, one-sixth homogeneous immersion, four-tenths, and three inch, Bausch & Lomb, also one-fourth and one inch Spencer. Four eye-pieces. Objectives are the best made. Address Mrs. Marion Smith, 41 Branch Street, Lowell, Mass.

—Saxon & Co., London, will publish in March an English edition of Félix Régamey's "Japon Pratique," an explanation of the Japanese modes of working in wood, metal, lacquer, porcelain, and stuffs, accompanied by more than a hundred designs.

—Macmillan & Co. announce for early publication a new volume of the Library of Philosophy, entitled "The Philosophy of Aesthetics," by Bernard Bosanquet, A.M., author of "Logic; or, the Morphology of Knowledge," and translator of Lotze's "System of Philosophy."

—Longmans, Green, & Co. announce a new edition of "A Hand-book of Florida," by Charles Ledyard Norton.

—The opening article of the February *Popular Science Monthly* will be on "Personal Liberty," by Edward Atkinson and Edward T. Cabot. It bears chiefly on the labor question, giving the results of an exhaustive examination of the decisions of the courts concerning restrictions on hours and modes of labor, regulation of the method of payment, etc. The pottery articles in the industrial series will be followed by two on another attractive subject—the making of musical instruments, by Daniel Spillane. The first of these, to appear in February, is devoted to "The Piano-Forte." It describes the precursors of this instrument, and recounts the steps of improvement by which this country has reached its present high position in the piano manufacture. The article is illustrated. President David Starr Jordan of Stanford University will have an account of how the hot-springs and lava-cliffs of the Yellowstone Park were formed, and what adventures have befallen the finny inhabitants of its lakes and streams. The article is called "The Story of a Strange Land," and it will be illustrated with several full-page and smaller views. "Urban Population" is the subject of the fourth of the Lessons from the Census, by Hon. Carroll D. Wright. It shows just how much ground there is for the current apprehension in regard to the increase of the slum population of cities. This paper also will appear in the February number.

SCIENCE

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QUERY.

Can any reader of *Science* cite a case of lightning stroke in which the dissipation of a small conductor (one-sixteenth of an inch in diameter, say,) has failed to protect between two horizontal planes passing through its upper and lower ends respectively? Plenty of cases have been found which show that when the conductor is dissipated the building is not injured to the extent explained (for many of these see volumes of Philosophical Transactions at the time when lightning was attracting the attention of the Royal Society), but not an exception is yet known, although this query has been published far and wide among electricians.

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N. D. C. HODGES,
874 BROADWAY, NEW YORK.

SCIENCE

NEW YORK, JANUARY 22, 1892.

"DIVINE HEALING."[1]

About twenty years ago a half-educated trifler from Germany, babbling, as they all do now, a travesty of undigested "metaphysical philosophy" displayed in a nimbus of religious cant, concerning whom the most injurious reports were circulated and have never been contradicted — this man became the apostle of a large following, and the worthy founder of the most notorious of the "schools" spawning ever since in the shallow waters of "Christian science," and there is of late a pitiful increase of faith, particularly on the part of religious people, in the prayers, promises and neglect of these healers, until cancer, diphtheria, and typhoid are left without challenge or remorse in the control of "Divine Healers," "Christian Scientists," "Faith" and "Mind Curers," and "inspired" persons in all garbs, who advertise variously, while each calls all others "quack."

Here is a "philosophy" which literally insists that there is neither pain nor disease;[2] cancer is an imagination. How patient, after all, are our legislators!

Serious argument against the hypocritical nonsense of these parasites in the medical profession would hardly have seemed called for, — so silly is the silliness, so crazy the craze, — were it not true that their influence is widely and perniciously felt. As keen an observer as Mr. Edward Eggleston has thought the status of "Christian Science" so serious an evil that his last work, "The Faith Doctor," is a strong indictment of its murderous counsels.

Popularity is easily gained, for the dead tell no tales. Christian Science murmurs its experimental prayer over the sick as material, while its triumphal march gathers a noisy ovation from the imaginative, the neurotic, the convalescing, and from certain surgical cases, stiff-jointed, rheumatic, or weak, and simply needing reassurance to take up beds and walk. From New England to the extreme West, towns and communities swarm with the new "practitioners." "The number of these regularly graduated cannot be accurately estimated, but they are numbered by the thousand. Within the limits of one school there are about thirty organized churches, and also one hundred and twenty societies which maintain regular services."[3]

Numerous periodicals make their appeal in such priestly vestments as have never been assumed by *Ayer's Almanac* or the most plausible of the *Guides to Health*. Twenty-three institutes, scientific and metaphysical, are advertised in one periodical.[4]

Here whoever listens becomes a titled practitioner (C.S.) and is "inspired," however brief the course of instruction. "There are about fifty dispensaries and reading-rooms, and a rapidly increasing literature for Christian Science; one of the other schools, Mind Cure, has also a large number of organizations similar in character."[5]

Reputable physicians occasionally yield to the importunities of patients, or the specious argument from the assumed standpoint of religion, and endorse the practice of Faith Cure, wholly or in part. Given an inch, an ell is taken, and the fanatical statement has already been made that there exists no opposition to Divine Healing on the part of medical men.[6]

Yet every veracious medical article and authentic report written during the past decade to show the service of air, diet, exercise, baths, or medication, is the enlightened protes of science, i.e., of confirmed and verified experience, in opposition to sensational, hysterical, superstitious pseudo-science.

Concession on the part of any physician to the childish credulity of a bygone age is simply high treason to his noble profession. A medical man who is still conducting cases of successful treatment should reflect upon his ingratitude to Alma Mater, and upon the comment which must greet a step which seems to stultify his own professional life and give support to a dangerous class in the community. His colleagues will, inevitably, question his sincerity and ask for a logical defense.

Religious observances have their time and place, but the Almighty evidently always employs means; the preachers are accepted agents in matters spiritual, perhaps the doctors are the convenient instruments to cure disease.

A disorder so serious, visible, established, and contagious as diphtheria, is not to be left to faith and prayer alone. The writer has never seen a cure wrought by such agency; but he has met with several instances where, in this disease, faith without works has brought adout a most disastrous result. Prayer accompanying unskilled attendance in childbed has proved to be infanticide.

The fact remains (statistics are stubborn) that "The Prayer Test" submitted some years ago was unsuccessful in application, both here and in England, and it is not now referred to by those who so confidently offered it.

Consumption is unwisely chosen as a chief example of the hopelessly incurable, therefore to be abandoned to prayer.[7] Dr. Cullis has here failed to help;[8] the bacteria still defy his methods. But medical science accomplishes very much in this disease, more and more from year to year. Even the removal of patients to antiseptic air and a warmer climate completely cures in many instances. Dr. Burnett recently reported fifty cases of advanced consumption of the lungs cured in England in spite of the climate, and medical authorities are nearly unanimous in promising aid at early stages of phthisis. Why should we, so equipped with books, professional training, experience, and a sense of responsibility toward our fellows, abandon the care of consumption to the pseudo-scientists?

[1] A portion of this paper was published in Boston Transcript, Dec. 21, 1891, in reply to a communication, Boston Transcript, Nov. 7, favoring Divine Healing as "the more excellent way."

[2] "Science and Health," pp. 188, 190, 231, etc. "You say a boil is inflamed and painful, but that is impossible" (231). "Inflammation, tubercles, hemorrhage and decomposition are but thoughts, beliefs" (188).

[3] American Spectator, Dec., 1891.

[4] Christian Science Journal, Jan., 1892.

[5] Am. Spectator, Dec., 1891.

[6] Journal of the Evangelical Alliance, Nov. 14, 1891.

[7] Boston Transcript, Nov. 7; Chr. Science Journal, Jan., 1892; Science and Health, p. 188.

[8] In the Consumptives' Home, a large faith institute, located in Boston.

It is most emphatically true, and to be recognized by every thoughtful mind abreast with the currents of modern life, that, underneath all the enormous quackery and folly of the healers, there are certain tendencies in the movement which are true and which have given to it power and influence. An influence early seen among us, and which, we trust, will be perpetuated as a final boon to the sick, was the leading of popular thought, in a hard and sceptical time, into a more spiritual conception of disease. Rightly applied, and by educated persons, such forces in nature as mesmerism (hitherto misapplied), and the still questionable hypnotism, seem destined to be of inestimable service in the treatment of all sickness, most obviously in disturbances of the nervous system.

Happily,

> "The qualities that soothe and heal and bless
> Are scattered at the feet of men like flowers."

There are men and women everywhere who forget fear and self and give out their beautiful life to the sick. No intelligent physician now neglects the mental, even the psychic states of his patients. Subtle gifts and powers are seen in the highest, or philanthropic, type of the medical man; fortunate is the patient whose doctor adds all noble ways and works to his professional acquirements. Abercrombie, Bigelow, and Clark were, temperamentally, sunshine, faith, patience, and hope.

Such ministrations are, however, but accessory to medical treatment, and should not arrogate the powers and functions of science,

> "For who shall change, by prayers or thanksgivings,
> The mystery of the cruelty of things?"

When the son of Mr. Moody, the revivalist, lay sick of scarlet fever, Mr. Moody's daily prayer, thousands helping him in the great tabernacle, was for the doctor's guidance. "May my boy's doctor be directed, and may he save my child!" That doctor's attitude toward revivals was so questionable that the boy's cure by prayer in this partnership was one among numerous modern miracles. But the M.D.'s chosen by D.D.'s are quite apt to be unbelievers. Even missionaries are shockingly delinquent in this matter, and waste no time by employing the mongrel attachés who follow the fathers, if only a scoffer full of knowledge be at hand. How often has the writer seen this wise prudence exercised by the mission leaders of the Sandwich Islands.

Perchance, to aid us all, a class of honest healers or helpers will at last arise whose representatives may not call themselves divine, and may not assume to cure all contagious and organic disease.

I venture, finally, to apply to the mental healers(?) words of an eloquent writer directed against others accused of like delinquency: "They trust to nature, which cannot, like an intelligent surgeon, bring together the gaping lips of a wound, and by their union effect a cure; which, not knowing how to tie a wounded artery, suffers a man in full health and energy to bleed to death; which, in order to remove a splinter from the cornea, destroys the whole eye by suppuration. In an affair so important as that of healing, a profession requiring such intelligence, judgment, and skill, how could they blindly take the vital power for their best instructor and guide, whilst reflective reason and unfettered judgment, those magnificent gifts of the Deity, have been granted to man to enable him infinitely to surpass its performances for the benefit of mankind?"

C. F. Nichols, M.D.

NOTES AND NEWS.

The *Illustrated American* says: "It has been decided that it is necessary to send an expedition to Greenland this year to rescue Mr. Peary and his party. The necessity being admitted no one will object to the relief expedition. But it does seem proper to recall some of the conditions under which the original party started. Mr. Peary sought, before his departure, to inspire the belief that the difficulties encountered by previous Arctic explorers would be avoided in a large measure. In this position he was sustained to some extent by the wonderful journey across Greenland performed by Dr. Fridjof Nansen. After passing the barriers of snow and ice on the coast, he hoped to travel over the snow plains of the interior without difficulty on the *skier* that served Dr. Nansen so well. After the expedition started it was discovered that he had taken too rosy a view of the prospect. His arrangements were not so complete as they should have been; so simple a matter as obtaining the co-operation of the Danish Government, and the assistance of the officials in Greenland, had been overlooked. When the party that accompanied him to Greenland returned, grave apprehension for the safety of himself and his companions was felt. And the feeling of apprehension becomes intensified when it is remembered that one of the persons thus subjected to unnecessary risks of suffering, starvation, and perhaps death among Arctic snow wilderness is a woman, Mr. Peary's brave wife."

— We learn from *Mind* that the second session of the International Congress of Experimental Psychology will be held in London, on Tuesday, Aug. 2, 1892, and the three following days, under the presidency of Professor Henry Sidgwick. Arrangements have already been made by which the main branches of contemporary psychological research will be represented. In addition to the chief lines of investigation comprising the general experimental study of psychical phenomena in the normal human mind, it is intended to bring into prominence such kindred departments of research as the neurological consideration of the cerebral conditions of mental processes; the study of the lower forms of mind in the infant, in the lower races of mankind, and in animals, together with the connected laws of heredity; also the pathology of mind and criminology. Certain aspects of recent hypnotic research will also be discussed, and reports will be given in of the results of the census of hallucinations which it was decided to carry out at the first session of the congress (Paris, 1889). Among those who have already promised to take part in the proceedings of the congress may be named the following: Professor Beaunis, Monsieur A. Binet, Professor Pierre Janet, Professor Th. Ribot, and Professor Richet (France); Professor Lombroso (Italy); Dr. Goldscheider, Dr. Hugo Münsterberg, Professor G. E. Müller, Professor W. Preyer, and Dr. Baron von Schrenk-Notzing (Germany); Professor Alfred Lehmann (Denmark); Professor N. Grote and Professor N. Lange (Russia); Dr. Donaldson, Professor W. James, and Professor Stanley Hall (United States of America); and Professor V. Horsley, Dr. Ch. Mercier, and Dr. G. J. Romanes (England). It is also hoped that Dr. A. Bain, Professor E. Hering, and others, may be able to take part in the proceedings; and that some, as Professor W. Wundt, who will not be able to attend the congress, may send papers. As a specimen of the work that will be done it may be said that Professor Beaunis will deal with Psychological Questioning; Monsieur Binet with some aspect of The Psychology of Insects; Dr. Donaldson with Laura Bridgman; Professor Stanley Hall with Recent Researches in the Psychology of the Skin; Professor Horsley with The Degree of Localization of Movements and Correlative Sensations; Professor Pierre Janet with Loss of Volitional Power; Professor N. Lange with Some Experiments and Theories concerning the Association of Ideas; Professor Lombroso with The Sensibility of Women, Normal, Insane, and Criminal; Dr. Münsterberg with Complex Feelings of Pleasure and Pain; and Professor Richet with The Future of Psychology. A committee of reception has been formed, which includes, among others, the following names: Dr. A. Bain, Dr. D. Ferrier, Mr. F. Galton, Dr. Shadworth Hodgson, Professor V. Horsley, Dr. Hughlings Jackson, Dr. Charles Mercier, Professor Croom Robertson, Dr. G. J. Romanes, Mr. Herbert Spencer, Mr.

G. F. Stout, Dr. J. Ward, and Dr. de Watteville. The fee for attendance at the congress is ten shillings. Arrangements will be made for the accommodation of foreign members of the congress at a moderate expense. Communications are invited, which should be sent to one of the honorary secretaries (F. W. H. Myers, Leckhampton House, Cambridge; or James Sully, East Heath Road, Hampstead, London, N.W.) not later than the end of June, and as much earlier than that date as possible. The communication should be accompanied by a *précis* of its contents for the use of members.

— In a recent number of the *Revue Médicale de la Suisse Romande,* Dr. Grandjean has related a case of very great interest. It is that of a man of thirty-four, who, with the exception of an attack of somnambulism at the age of eight — an attack in which he had walked into his father's bedroom and congratulated him on being elected king of Italy — had been previously healthy. Towards the end of January, 1890, he began to suffer from nightmare and depression, without apparent cause, but he had no headache or vomiting. This condition persisted for two weeks. Then, on Feb. 9, after going to his office and working as usual, at nine o'clock in the morning he took his hat, set out on foot, and arrived at Payerne, a village fifty kilometres distant. He had no recollection of anything that happened from the time he left his office until he awoke, in the middle of the night, in an inn at Payerne. His boots, he found, were much worn, but his clothes were in good order. He presented none of the usual effects of having passed through an epileptic paroxysm, except that he had a violent headache. After this he remained as usual for seven months, except that he had occasional "absences." Thus, on one occasion, while writing, he was surprised to find that he had continued at his work for an hour without any recollection of having done so. The work was done perfectly, without a single mistake. At the end of the seven months he had another attack similar to the first, but lasting for two days, during which he had gone about to different places acting in a manner which did not strike any observer as strange or peculiar, but being all the time unconscious. Five months later he had a similar, even more elaborate, attack, which also lasted for two days, and was followed by headache more violent than usual. Dr. Grandjean comes to the conclusion that this is undoubtedly a case of epileptic automatism. He does so from the nature of the attacks, from the fact that the man also suffered from "absences" of longer or shorter duration, really attacks of *petit mal,* and because the latter became almost totally suppressed under treatment by the bromides. The case is an important one, and it should serve to impress the fact once more that some criminals who profess complete unconsciousness of the act or acts with which they are charged may really be the subjects of epileptic automatism. If this patient had committed some crime during one of those periods of unconsciousness, a defence to the effect that he was the subject of epilepsy would have been received with considerable doubt, especially as there was nothing in the nature of a severe fit to point to in the former history, but only those temporary "absences" without any obvious convulsion.

— At the meeting of the Chemical Society of Washington, Jan. 14, Professor H. W. Wiley presented a paper on "Midzu-ame." The sample of midzu-ame or Japanese glucose analyzed by Professor Wiley was brought to the laboratory of the Agricultural Department by Dr. W. St. George Elliot, having been sent to him from Yokohama by Mr. J. H. Loomis. A sample of heavy confectioner's glucose was analyzed at the same time and the two compared. The characteristic of the midzu-ame is its high percentage of maltose, nearly all of the reducing sugar present being maltose. The ash of the midzu-ame contained only a trace of sulphates, no lime, no chlorium, and was strongly alkaline. The ash of the confectioner's glucose contained large quantities of sulphates, very little lime, and was also alkaline. The pleasant flavor of the midzu-ame seems to render it preferable to glucose for confectioners' use, and Professor Wiley thought it may be destined to have an important future in this respect. He referred to its use in Japan, where it has been used for medical purposes with dialyzed iron and cod liver oil. Its only advantage over maltine is its easy digestibility. Professor Wiley also described the methods of manufacture in Japan as given by Dr. J. C. Berry and by Mr. Loomis. W. F. Hillebrand, in his paper on "Zinc-bearing Spring Waters from Missouri," described the springs as issuing from a low bluff a few miles south-west of Joplin, and their chief constituent as zinc sulphate, amounting to three hundred parts per million in a total weight of less than twice that amount of salts. Cadmium, lead, and copper were found in small quantity, and the other constituents were sulphates of calcium, magnesium, sodium, potassium, manganese, aluminium, and iron; also calcium carbonate, silica, and a small amount of sodium chloride.

— Professor Albert A. Michelson of Clark University has been invited by the International Bureau of Weights and Measures to spend the coming summer at the Bureau's laboratory at Breteuil, near Paris, for the purpose of establishing a metric standard in terms of wave lengths of light. Of the three methods of determining a standard of length, the measuring a quadrant of the earth's circumference, the oscillation of a pendulum under given conditions, and the length of light waves at a given line in the spectrum, the last is the most accurate and has the advantage of being a cosmic rather than terrestrial standard. In his original paper explaining the method, Professor Michelson had the cooperation of Professor Morley of Cleveland. The invitation of the International Committee has been accepted by Professor Michelson with the informal approval of the president and trustees of Clark University. Their formal action in granting him leave of absence only awaits the arrival of official papers from Paris and Berlin. The order for the additional new apparatus has been placed with the American Watch and Tool Company of Waltham and with Mr. Brashier of Pittsburg. The working drawings have been made by F. L. C. Wardwell. Professor B. A. Gould of Cambridge, the well-known astronomer and American representative of the International Congress of Weights and Measures, writes to President Hall as follows: "The proposed investigation is a magnificent one, audacious, yet already proved by Professor Michelson to be feasible. The honor inuring to our country by the selection of an American professor to carry it out and an American artist for constructing an apparatus requiring such surpassing delicacy is one which, I am confident, you will appreciate as highly as I do. It is my conviction that the assent of Clark University will not only redound to its high honor and be gratefully recognized throughout the civilized world, but will constitute an enduring title to remembrance and full appreciation in the history of science. It seems to me a just source of pride that our country should be called on to take the chief part, both scientific and technical, in such an undertaking, and I will not deny that I am considerably elated by it." Telegrams from Professor Foerster at Berlin and Hirsch of Switzerland, president and secretary, respectively, of the International Bureau, have been received, ratifying all arrangements.

— The Indiana Academy of Science held its annual meeting in the Capitol at Indianapolis, Dec. 30 and 31, 1891, under the presidency of Professor O. P. Hay of Butler University, Irvington, Ind. Owing to the great number of papers entered, it was necessary, throughout the most of the meeting, to meet in two sections: Section A., zoology, botany, and geology; Section B., chemistry, physics, and mathematics. On Wednesday morning and evening general sessions were held. At the latter the president's address on "The Present State of the Theory of Organic Evolution" was delivered. There were ninety-eight papers entered, and under the rules none were permitted on the programme except such as were expected to be read. The committee appointed at the summer meeting of the Academy, at Lake Maxincuckee, to consider the question of science work in the high schools of the State reported that it had brought the subject to the attention of the State Board of Education, with the result that the presidents of Purdue University and Indiana University were appointed a committee to prepare a circular of instruction, to be distributed by the board to high schools and to school officers. The circular is nearly ready for distribution. The committee appointed to secure the passage by the legislature of an act to protect native birds reported that such legislation had been secured. The following papers were presented: Some Suggestions to Teachers of Science or Mathematics in High Schools, by T. C. Van Nuys; Notes on Numerical Radices, by C. A. Waldo; The Kankakee and Pure Water for North-western Indiana and Chicago, by J. L. Campbell; Biological Surveys, by John M. Coulter; The Distribution of Tropical Ferns in Peninsular Florida, by L. M. Underwood; Unused Forest Resources, by Stanley Coulter; Preliminary Notes on the Geology of Dearborn County, Ind., by A. J. Bigney; Jefferson County Cystidians, Hudson River Fossils of Jefferson County, Ind., and The Upper Limit of the Lower Silurian at Madison, Ind., by George C. Hubbard; Variations in the Dynamical Conditions During the Deposit of the Rock Beds at Richmond, Ind. (by title), by Joseph Moore; The Relation of the Keokuk Groups of Montgomery County with the Typical Locality, and Comments on the Description of Species, by C. S. Beachler; On a Deposit of Vertebrate Fossils in Colorado by Amos W. Butler; Topographical Evidence of a Great and Sudden Diminution of the Ancient Water Supply of the Wabash River (by title), and Source of Supply to Medial Moraines Probably from the Bottom of the Glacial Channel (by title), by J. T. Campbell; Notes on a Kansas Species of Buckeye, by W. A. Kellerman; On the Occurrence of Certain Western Plants near Columbus, Ohio, by Aug. D. Selby; Preliminary Notes on the Genus Hoffmanseggia, by E. M. Fisher; Preliminary Paper on the Flora of Henry County, Ind. (by title), by T. B. Redding and Mrs. Rosa Redding Mikels; A New Microtome, by George C. Hubbard; Notes on the Organogeny of the Compositæ (by title) by G. W. Martin; Notes on the Development of the Archegonium and Fertilization in Tsuga Canadensis and Pinus Sylvestris, by D. M. Mottier; Strange Development of Stomata upon Carya Alba Caused by Phylloxera, by D. A. Owen; Development of the Sporangium and Apical Growth of Stem of Botrychium Virginianum, by C. L. Holtzman; The Flora of Mount Orizaba, by H. E. Seaton; An Apparatus for Determining the Periodicity of Root Pressure, by M. B. Thomas; Condensation of Acetophenone with Ketols by Means of Dilute Potassium Cyanide, Condensation of Acetone with Benzoin by Means of Dilute Potassium Cyanide, and Pyrone and Pyridone Derivatives from Benzoyl Acetone, by Alexander Smith; Carbonic Acid in the Urine, by T. C. Van Nuys and R. E. Lyons; Results of Estimations of Chlorine in Mineral Waters, by Volhardt's Method, by Sherman Davis; The Sugar Beet in Indiana, and Forms of Nitrogen for Wheat, by H. A. Huston; A Copper Ammonium Oxide, by P. S. Baker; Di-benzyl Carbinamine, and The Character of Well Waters in a Thickly Populated Area, by W. A. Noyes; Laboratory and Field Work on the Phosphate of Alumina, by H. A. Huston; Recent Archæological Discoveries in Southern Ohio, by Warren K. Moorehead; Photographing Certain Natural Objects without a Camera, by W. A. Kellerman; Recent Methods for the Determination of Phosphoric Acid, by H A. 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Webster; The Continuity of the Germ Plasm in Vertebrates (by title), Biological Stations (by title), The Eyes of Blind Fishes (by title), and On the Presence of an Operculum in the Aspredinidæ (by title), by Carl H. Eigenmann; Notes on Indiana Arididæ (description of one new species), by W. S. Blatchley; The Relation of Neucleaplasm to Cytoplasm in the Segmenting Egg (by title), by C. H. Eigenmann and R. L. Green; Plant Zones of Arizona (by title), by D. T. McDougal; Relation of Available Enzym in the Seed to Growth of the Plant, and The Potato Tuber as a Means of Transmitting Energy, by J. C. Arthur; Contributions to a Knowledge of the Grain Toxoptera (Toxoptera graminum) (by title), by F. M. Webster. A committee was appointed to arrange for publishing the proceedings of this meeting. Twenty active members were elected.

— The College of Physicians of Philadelphia announces that the next award of the Alvarenga prize, being the income for one year of the bequest of the late Señor Alvarenga, and amounting to about one hundred and eighty dollars, will be made on July 14, 1892. Essays intended for competition may be upon any subject in medicine, and must be received by the secretary of the college on or before May 1, 1892. It is a condition of competition that the successful essay or a copy of it shall remain in possession of the college.

— A complete series of soundings has been taken over the whole bed of the Lake of Geneva, and a report is given in *Cosmos*, Vol, X, No. 9, by the engineer, M. A. Delebecque. The length of the lake is 45 miles and its greatest breadth 8½ miles. Its area is 223 square miles, and the height of its surface above sea-level about 1,230 feet. The bed of the lake is divided into two distinct parts, the Great Lake between Yvoire and Villeneuve, and the Little Lake between Yvoire and Geneva. The bottom of the Great Lake is nearly level over an area of 17¾ square miles, and lies at a depth of 169 fathoms. The slopes are more sudden at the eastern end, where the mountains descend more precipitously to the water, the inclination being 48 degrees between Saint-Gingolph and Bouveret, and 56 opposite the Castle of Chillon. The River Rhone has made a deep channel, lined with dykes, in the bottom of the lake. This channel extends in a tortuous course for a distance of 3½ miles from the mouth of the river. Near its commencement it has a depth of 190 feet, and beyond Saint-Gingolph it is still 30 feet deep, where the depth of the lake is 109 fathoms. Its formation is due to the large quantities of alluvium brought down by the Rhone, and to the lower temperature of its waters, which causes them to flow under the waters of the lake. The Dranse, which brings down gravel and stones, as well as mud, to the lake, has formed what is known as a *torrential* delta at its mouth, in the form of a cone, continually advancing further and further into the lake. The Little Lake consists of four depressions, separated by bars of small elevation, projecting from the points of Nernier, Messery, Hermance, and Bellerive. The depths of these basins are 249, 229, 229, and 164 feet, respectively. At the bottom of this portion of the lake are to be found traces of the passage of the ancient Rhone glacier which extended to Lyons.

The bar of Nernier, or at least its upper surface, has at one time formed part of a moraine. A bathymetrical map accompanies the article from which this note is taken.

— Mr. Edgar Richards, who, for the past four and a half years, has been in charge of the chemical laboratory connected with the Internal Revenue Bureau at Washington, D.C., having been peremptorily directed by his physician, Dr. F. Delafield of this city, to abstain from all work for some months in the department, has been forced to resign his position, as the Commissioner of Internal Revenue refused to grant him leave of absence in which to rest. Thus the government loses an efficient and faithful officer. Mr. Richards sails on the 23d of January, by the "Werra," for southern Europe, where he will remain for several months before returning to this country.

— From some further surface and bottom temperatures recently taken by Commander Boulton, R.N., in Lake Huron, A. T. Drummond, in this month's *Record of Science*, concludes that the Georgian Bay forms a great cold water basin, somewhat isolated, not only by its physical surroundings but in the temperature of its water, from the central basin of the lake; that the temperature of its bottom does not, even in summer, rise beyond about 39.2°; and that the flow of cold water from Lake Superior into Lake Huron is divided by the position of the islands in the St. Mary's River and along the north shore of Lake Huron, a part flowing to the Georgian Bay by the north channel, between the Manitoulin Islands and the north shore of the lake, thus keeping up the supply of cold water, whilst another part passes through the Detour and the neighboring channels into the central basin of the lake, but instead of mingling there with the warmer waters from Lake Michigan, appears to flow easterly and south-easterly, forming a barrier to the easterly extention of these warmer Michigan waters, and cutting off the Georgian Bay from their influence. In the same journal, Mr. Drummond also refers to a series of temperatures taken by him during last August in the Yamaska River, Province of Quebec, in order to trace the extent of the influence which water temperatures have upon the surrounding air, and, inferentially — in the case of large bodies of water — upon the agricultural capabilities of the neighboring land. The tests were not sufficiently varied as to time and place to, as yet, warrant definite conclusions, but it can be said in general terms that such rivers, which in winter, in the Canadian climate, are paved with two or more feet of ice, have, in the early days of August, a temperature of 76° to 77° F.; that the air in direct contact with the warm surface of the water has in that month its temperature raised to from 1° to 5° above that of the air directly above, but in more exposed positions; and that this increase of temperature, which is greatest at the point of contact, is at one foot above the surface already to a considerable extent lost.

— Harper & Brothers announce a new and revised edition of Autenrieth's valuable "Homeric Dictionary," translated by Professor Robert P. Keep. The present revision has been performed by Professor Isaac Flagg of the University of California, whose name alone is a guarantee of its excellence. Almost every American Greek scholar of reputation has also aided in the work by suggesting corrections or helpful additions, and no effort has been spared to adapt the volume perfectly to the needs of American and English students. Several important changes of considerable value have also been made. They will publish shortly in the Queen's Prime Ministers series "The Marquis of Salisbury," by H. D. Traill.

— A volume entitled "The Dog in Health and in Disease," by Dr. Wesley Mills, and published by D. Appleton & Co., discusses in detail the history of all the varieties of dogs, their breeding, education, and general management in health, and treatment in disease. The book is adapted for both the veterinarian, to whom the medical care of dogs is usually confided, and the general reader whose interest may be limited to that involved in the ownership of a single animal. The writer is professor of physiology in the faculty of Veterinary Science of McGill University, Montreal, the author of "Comparative Physiology" and other standard works on allied topics; and is further qualified for his task by the fact that he has, as he states in his preface, "for the greater part of his life studied this noble animal with pleasure and profit to his own nature." The volume contains a large number of illustrations related to the text, and is further embellished by portraits of various dogs of note of many breeds.

— Charles Scribner's Sons announce that the first two volumes to be published in the Great Educators Series will be "Aristotle, and the Ancient Educational Ideals," by Thomas Davidson, and "Loyola, and the Educational System of the Jesuits," by the Rev. Thomas Hughes of Detroit College. The next volume, the fifth, in the University Extension Manuals will be "French Literature," by H. G. Keene of Oxford. They have just published "Ten Centuries of Toilette," translated from the French of A. Robida by Mrs. Cashel Hoey, and uniquely illustrated in colors and in black and white by the author. The unexpected delay in the publication of Edward Whymper's "Travels Amongst the Great Andes of the Equator" has been due to the unusual care and thoroughness with which the author is revising the proofs before allowing the book to go to press. It is thought, however, that the book will be ready for publication in a few weeks.

— Longmans, Green, & Co. are about to publish a new work in two volumes on "The Human Mind," by James Sully, of which the author says in a communication to *Mind*: "The present work is an expansion and further elaboration of the doctrine set forth in the author's 'Outlines of Psychology.' Although the mode of arrangement and of treatment will in the main be found to be similar, the book may be described as a new and independent publication. It is specially intended for those who desire a fuller presentment of the latest results of psychological research than was possible in a volume which aimed at being elementary and practical. Hence much more space has been given to the new developments of 'physiological' and experimental psychology, to illustrations of psychological principles in the phenomena of racial and animal life, of insanity and hypnotism. At the same time, an effort has been made to illustrate the obscurity and debatableness of many of the problems of the science, and to aid the reader in arriving at a judicial conclusion on these points by historical references to the main diversities of doctrine. In this way it is hoped that the treatise will find its proper place beside the 'Outlines.'"

— D. Appleton & Co. will publish immediately the third volume of Professor J. B. McMaster's "History of the People of the United States." The second volume closed with the negotiations regarding the Louisiana purchase. In the new volume, which contains ten chapters, Professor McMaster begins with the discussion regarding the constitutionality of the Louisiana purchase. The first chapter includes a careful presentation of the manners, customs, and special characteristics of the people of New Orleans, and the connection of the New England leaders and of Burr with the Louisiana question. The second chapter treats of the results of the Louisiana purchase, the conspiracy of Aaron Burr, his expedition in the Ohio Valley, and his arrest and trial. The third chapter is devoted to the conduct of the public lands from 1776 to the establishment of the Territories of Illinois and Michigan. The fourth chapter, entitled "The Spread of Democracy," describes the extension of the franchise, the relations of the people and the judiciary, and the presidential campaign of 1804. The fifth chapter, which has for its heading the old cry of "Free Trade and Sailors' Rights," is principally devoted to foreign relations, from the Barbary War to the passage of the embargo. The sixth chapter treats of the "Long Embargo," and closes with the inauguration of Madison. After a chapter on subsequent events, called "Drifting into War," the author pauses for a description of the progress of the people since 1784, showing the changes, political, economical, and social, the development of means of communication, the building up of manufactures, the arguments for protection, the relations of the people to the slavery question, and the Seminole War. In the closing chapter the author pictures the preparations for the War of 1812 and its disastrous opening, with the surrender of Hull at Detroit The volume contains two maps, an index, and an elaborate table of contents.

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FORTY YEARS OF WHEAT CULTURE IN OHIO.[1]

OHIO lies within the borders of what is known as the winter wheat belt of the United States — a region, the soil and climate of which are especially adapted to the culture of this cereal. The State possesses two great natural arteries of traffic, one on its northern and one on its southern boundary, and before the advent of the railway it was crossed by two lines of canals, each extending from the lake on the north to the river on the south, and affording outlets for its productions that served a very important function in its early history. Lying, as it does, right in the gateway between the East and the West, it has been crossed by line after line of the great transcontinental railways, while its rich mineral resources have caused the building of multitudes of other lines, running in all directions, until its territory is now traversed by a network of railways, aggregating within the State nearly 8,000 miles of main track, besides more than 2,000 miles of sidings.

Under such circumstances it is not surprising that the culture of wheat became at an early date, and has ever continued to be, a leading branch of Ohio's agriculture, and that the State should not only have liberally supplied itself with bread, but have had much to spare.

Because of this relative prominence of wheat culture in the agriculture of the State, the Experiment Station has made the study of wheat a leading feature of its work, and the statistical study now published has been undertaken primarily for the purpose of obtaining such assistance as it might give in the conduct of the station's experimental research. It was hoped that this study might throw some light upon such problems as the relative adaptability to wheat culture of soils of different geologic origin and history, and the effect of differences of latitude, of drainage, and the use of commercial fertilizers, and it is believed that some of the conclusions which it seems to warrant should be carefully considered by the farmers of large areas of the State.

[1] From the Bulletin of the Ohio Agricultural Experiment Station, Nov., 1891.

A glance at the geological map of Ohio shows three broad bands running across the State from north to south. That on the east embraces the coal measures, and extends across nearly one-third of the State; then follows a narrower strip, underlaid with Waverly rocks and bordered by a narrow belt of Huron Shales, while the western half of the State lies over limestones.

As the Waverly rocks are chiefly sandstones or calcareous shales, this formation would offer a sharp contrast between soils of such origin and those derived from limestones, were it not for the fact that, in the case of Ohio, both these formations are covered with a thick bed of glacial drift. The drift, however, is considerably modified by the underlying rocks, and it would seem that if there were any marked differences in the value for wheat culture of soils of the widely different character produced from these different formations it should be indicated in this case.

Omitting the four counties in the north-western corner of the State, which overlie the outcrop of Huron shale in that region, viz.: Williams, Fulton, Defiance, and Henry; the five counties which lie on both sides of the belt of Huron shale, extending north and south through the State, namely: Erie, Crawford, Delaware, Franklin, and Pickaway, and the five counties lying immediately north of the coal region and chiefly over conglomerates, namely: Lake, Geauga, Ashtabula, Summit, and Trumbull, the remaining seventy-four counties have been divided into three parallel belts, according to latitude, and subdivided according as they lie over the limestones, shales, or coal measures, making nine groups in all.

In the northern belt are included twelve limestone counties, viz.: Lucas, Ottawa, Wood, Sandusky, Paulding, Putnam, Hancock, Seneca, Van Wert, Allen, Hardin, and Wyandot; seven counties over the Waverly, viz.: Lorain, Cuyahoga, Huron, Medina, Richland, Ashland, and Wayne, and six counties over coal, viz.: Portage, Mahoning, Stark, Columbiana, Holmes, and Carroll.

In the middle belt are eleven limestone counties, viz.: Mercer, Auglaize, Marion, Shelby, Logan, Union, Darke, Miami, Champaign, Clark, and Madison; four Waverly counties, viz.: Morrow, Knox, Licking, and Fairfield, and seven coal counties, viz.: Coshocton, Tuscarawas, Harrison, Jefferson, Muskingum, Guernsey, and Belmont.

In the southern belt are twelve limestone counties, viz.: Preble, Montgomery, Greene, Fayette, Butler, Warren, Clinton, Highland, Hamilton, Clermont, Brown, and Adams; three Waverly counties, viz.: Ross, Pike, and Scioto, and twelve coal counties, viz.: Perry, Morgan, Noble, Monroe, Hocking, Athens, Washington, Vinton, Meigs, Jackson, Gallia, and Lawrence.

It appears that in the northern belt the counties over Waverly rocks have given a larger average yield over the entire forty-year period under review than those in the same latitude, which are underlaid with limestones or with the rocks of the coal measures, and that the rate of increase in yield during the past twenty years is also larger in the counties over the Waverly.

In the middle belt the result is just the opposite: the limestone counties show the larger yield and the greater rate of increase.

In the southern belt the limestone counties show the larger yield, but the Waverly counties show a greater rate of increase.

The counties overlying the coal measures stand below either of the other divisions in yield per acre in each of the belts, the difference increasing in the more southerly latitudes. In rate of increase they stand between the other two divisions. The topography of these hilly, coal counties is a sufficient cause for their lower yield, and is probably the chief cause, as the rocks of the coal measures comprise both limestones and shales, and it is probable that the soils derived from them are not naturally inferior in fertility to those found in the remainder of the State.

As between the soils lying over limestones and those over shales, these statistics do not yet justify any opinion regarding their respective adaptation to the production of wheat. It is probable, however, that the middle and southern belts of counties afford a more just basis of comparison between the two geological formations than the northern belt, because in this northern region the overlying drift has been derived, to a large extent, from the rocks excavated from the lake basin, and which are both limestones and shales.

Within twenty years the area annually sown to wheat in Ohio has increased from an average of 1,800,000 acres during the eighth, to 2,500,000 acres during the ninth decade. This area represents twelve per cent of the area in farms within the State, but several counties are sowing annually 18 to 20 and even 25 per cent of their farm lands to wheat. In 1881 a total area of 2,800,000 acres was sown, and there is no good reason to doubt that with the continued clearing away of the forest and the reclamation of waste lands by drainage it will soon be possible to devote as much as 3,000,000 acres to wheat without infringing upon any other agricultural interest, and this, even though the hill counties should reduce their acreage by one-half. Such an increase, at the present rate of production, would represent an annual product of 40,000,000 bushels.[1]

But it is not to be supposed that Ohio farmers will rest content with a yield of only thirteen bushels of wheat per acre. The northern third of the State has increased its average yield within forty years by nearly three bushels, and the middle third by from one to two bushels, and it is reasonable to expect a similar increase within the next forty years, notwithstanding the fact that the rate of production seems just now to be at a standstill. It is to be expected that progress in this, as in other matters, will be more or less spasmodic, and that its actual rate can only be measured at long intervals; but it is not impossible that the time may come when the average from the entire State will equal the present average of Summit county, which means a total average production of about 60,000,000 bushels, or bread for twelve million mouths. Such a yield would be far below what has been attained in Great Britain, where the average yield is now 28 bushels or more per acre and is steadily increasing. This high yield is not due solely to the superiority of the soil and climate of that country, for the time has been when the average yield of Great Britain was very much smaller than it is at present.

Ohio's population has increased by a little more than two millions since 1850, while the total wheat yield has increased by an average of more than 14,000,000 bushels per annum, comparing the average of the first decade with that of the decade 1850–9, so that production is keeping far ahead of any possible consumption within the State. Production will eventually reach a limit, while population may expand indefinitely, but at present rates of increase, both of population and of wheat production, it will probably be several centuries before Ohio shall contain enough people to consume all her wheat.

[1] 48,000,000 bushels were harvested in Ohio in 1888.

What is true of Ohio is true to a greater or less extent of the entire winter wheat belt of North America. The area now sown to wheat in this region may be expanded largely without infringing upon other productions, and the rate of yield may and will be very materially increased by better husbandry, including an intelligent use of manures and fertilizers, and more thorough drainage.

Let there be given a little stimulus in the shape of higher prices for wheat and we shall see a rapid expansion in the total production in this country, while there are still undeveloped regions in South America, south Africa, and Australia, which will eventually be made to add largely to the world's supply of breadstuffs.

This is not said by way of discouragement. I believe that the future outlook for the Ohio wheat grower is eminently a hopeful one, but I do not expect to see the very great increase in price of wheat that is being predicted by certain statistical writers. In my judgment, the great opportunity for the Ohio wheat grower lies in increasing the yield per acre, in reducing the cost of production, and in improving the quality of the grain. Such a course will render him independent of the market, and then if higher prices do come he will be doubly benefited.

It appears from this statistical study of the wheat harvests of Ohio that the average yield of wheat is increasing in the northern and central sections of the State, while it is at a standstill, and standing at far too low a point for profit, in the southern and south-eastern counties.

It would seem that the profitable culture of wheat on the steep hillsides of southern Ohio is a hopeless undertaking; that the great problem before the wheat grower of the central belt of counties is winter-killing, a problem which may be partially solved by underdrainage and the intelligent use of clover and manures; and that in the northern counties climatic influences are more generally favorable to wheat culture than elsewhere in the State.

The statistics indicate that the wheat crops of Ohio have been slightly increased by the use of commercial fertilizers, but it appears that the average cost of this increase has equaled its market value, and that a general improvement in the methods of agriculture has contributed more largely to the increase of Ohio's wheat crops than the use of purchased fertility.

It would seem that the total area under wheat might be considerably enlarged, and at the same time more closely restricted to lands adapted to tillage, and that the yield per acre may be so increased that the total product shall reach double the quantity now annually produced.

CHAS. E. THORNE.

THE ANTHROPOLOGY OF EUROPE.

"THE Anthropology of Europe" was the title of a course of lectures (the Rhind lectures) delivered in Edinburgh last October by Dr. Beddoe, ex-president of the Anthropological Institute of Great Britain, of which we find the following brief abstract in the *Scottish Geographical Magazine:* Dr. Beddoe, in his earlier lectures, dwelt chiefly on some of the problems of anthropology, briefly on the question of priority of dolichocephalic or brachycephalic types, briefly also on the great Aryan question, and at greater length on that of the influence of environment, towards modifying of types, to which he repeatedly referred during subsequent lectures. He noted the very frequent occurrence of broad, even very broad, skulls in conjunction with very narrow ones in some of the earlier, if not the earliest, "finds," a circumstance not yet sufficiently explained. He showed that we knew very much more about the succession of races and the details of ethnography, where these related to western Europe, especially to France, because these parts were inhabited, owing to the geological conditions, earlier than the north-eastern portions of Europe, while in the east and south-east generally, and in Spain, anthropological science was not sufficiently advanced, or political circumstances intervened, and investigators were few. With respect to the Aryan question, he pronounced no very decided opinion, though he spoke of certain doctrines on the original habitat as the Scandinavian and Lithuanian heresies; and he showed some inclination towards that view which looks on the Galchas as representing the ancestors of the Iranians and of the people who brought the Aryan languages into Europe, in which case the brachycephals of the central mountain chains, the Carpathians with the Balkans, Bohemian Mountains, the Alps, Jura, Vosges, Cevennes, etc., may be looked on as retaining much of the original Aryan blood, seeing that their physical characteristics have a general resemblance to those of the Galchas. He discredited the argument that because the Aryan-speaking inhabitants of Europe were more numerous than those of Asia, it was much more easy to derive the latter from the former, the less from the greater, than *vice versa*, remarking that on the same principle we should derive the English from North America and the Portuguese from Brazil, and that it was not at all unlikely that about the dawn of history, when Asia was thickly and Europe comparatively thinly peopled, the proportions were quite different, especially as at that time the Iberians were still unorganized as to language. With regard to the influence of environment he quoted Kollmann of Basel's five types: —

1. Long-headed long-faced, the Grave-row or Germanic, etc.,
2. Broad-headed long-faced, the Disentis or Sarmatic,
3. Long-headed broad-faced, the Cro-Magnon,
4. Broad-headed broad-faced, the Turanian,
5. Mesocephalic broad-faced,

but said he thought the types too few and the limits too absolute and precise as to figures.

He showed the extreme divergence of views on this subject of environment, — noting how Kollmann denied any change of types, or material progression therein, since the period when we knew anything of man in Europe, saying that man was fit for anything when he first appeared here, and that for the establishment of permanent varieties we must look further back, perhaps even into the Miocene age.

On the other hand, Schaaffhausen, Ranke, and, to a less decided extent, perhaps Virchow himself, assign very great importance to environment. The first indicates a large number of points of inferiority as occurring together or separately in the old dolichocephals, and believes that in Germany, if not elsewhere, heads are gradually growing broader with increasing intelligence and civilization, while Ranke thinks that in Bavaria, in some unexplained way, the inhabitation of mountain regions has a tendency to broaden and shorten the head, and that, where race concurs with environment, as as in the once-slavonic hill-country of Upper Franconia, the tendency is still more marked, as from a double influence. Dr. Beddoe then went briefly through the history of the successive expansions and "swarmings" or migrations of the several races who have successively been active in Europe,— the Phœnicians, the Greeks, the Gallo-Kelts, the Romans, the Germans, the Slavs, the Saracens, and the Turco-Tartar tribes, and their share in modifying race-distribution.

Proceeding to consider the history and ethnology of Russia, he stated his opinion that the Scythians, if not altogether Turanian, were a mixed race into which a Turanian element entered, and who ruled over other tribes of different descent from themselves. The ancient skulls had not been found or preserved in great number, but they were almost all long, up to the Slavonic period, when they became rather broad, very much what they are at the present day. The Merians around Moscow were a Finnish tribe, who about the tenth or eleventh century were being subdued or incorporated by the encroaching Muscovites, and who finally disappeared; they were tall and strong, but pacific in habits, and, though they had commerce with the Arabs and Bulgarians, were comparatively poor. The history of Russia was one of gradual absorption of Finnish tribes, interrupted for a long period by the great invasion and domination of the Mongols of the Golden Horde. The numerous Finnish tribes seemed to have something common in their physiognomy, but differed very much in their indices of head-breadth, and also to some extent in complexion, some having dark hair, others to a large extent fair or brown, and some a large percentage of red hair, e.g., the Votiaks and Voguls, who are incorrectly said to be all red-haired.

Dr. Beddoe thought the Illyrians probably furnished the principal source of the black-haired folk in the Balkan Peninsula; they were also broad-headed. He entered into some details as to the changes in the Greek type and the history of the Thracians, as well as of the colonization of Bulgaria by the people who now bear that name.

With regard to Scandinavia he quoted the discrepant views of Montelius and Aspelin, the former doubting or denying the arrival of any new race since the neolithic period, the latter tracing the true Swedes to the Rhoxalani (Red-men in Finnish), whom he supposed to have entered Sweden about the fourth or fifth century.

In treating of Germany he entered pretty fully into the question of the change which appears to have taken place in the physique of the Bavarians and Swabians since the Marcomanni and Alemanni occupied these countries, quoting the different opinions of Von Hölder and Ranke on the subject, and especially the investigations of the former at Ratisbon.

In France and Belgium the clearest and most conclusive mass of anthropological fact was supplied by the investigations of Vanderhindere and Houzé into the color, head-form, stature, etc., of the Belgians. A line drawn east and west between the Flemings and the Brabanters and the Walloons separated two races differing in language, color, stature, head-form, and length of nose, and that in the sharpest manner. In France Dr. Beddoe also mentioned the inquiries of Broca and Boudin into stature, of Topinard into color, and of Collignon into head-form, and their remarkable results; and in Spain those of Don Telesforo de Aranzadi y Unamono, into the physical characteristics of the Guipuzcoan Basques, whom he believed not to be a pure race, but a mixture of three distinct elements. In Italy he showed how the stature and the head-breadth decreased gradually from north to south, and how the Sards were probably the purest breed in Europe, and the best representatives of the Mediterranean or southern race; also how closely the modern seemed to resemble the ancient Romans. In Britain he selected for special remark Pembrokeshire and the Isle of Man, and analyzed the indications of stature, color, and head-form in the Manxmen, who were a cross-breed between the Gael and the Norseman in all these respects. In Scotland he selected for special remark the people of Berwickshire and of Ballachulish, showing that, though not very dissimilar in head-form, they were strongly distinguished in color of hair. He expressed his belief in the presence of a Finnish or Ugrian element in the population of Scotland, which was also found in Wales, and was marked among other characteristics by oblique eyes. The Iberian element, which had doubtless been strong among the Picts, continued to be so in many parts of Scotland, for example, in Wigtownshire and the upper part of Aberdeenshire, and in a great part of the Highlands.

The concluding part of the last lecture was devoted to an appreciation of the three (or, counting the Finns, four) great races which now divide Europe, of which the central, Alpine, brown, thick-set, broad-headed race seems the one most likely to spread at the expense of its neighbors. The question of race *versus* environment was also summed up, to the advantage, on the whole, of the former.

THE ABORIGINAL NORTH AMERICAN TEA.[1]

THERE is a shrub or small tree, a species of holly (Ilex cassine), growing in the Southern States along the seacoast, not extending inland more than twenty or thirty miles, from Virginia to the Rio Grande. Its leaves and tender branches were once used by the aboriginal tribes of the United States in the same manner as the Chinese use tea and the South Americans use maté. But while the use of *Thea sinensis* and *Ilex paraguayensis* still survives, the use of the shrub above mentioned has been almost abandoned by our native Indians and by the white people who once partially adopted it as a beverage.

The reason for its disuse is hard to discover, for, in common with tea and maté, it contains caffeine, or a similar alkaloid. The object of this paper is to examine its history, to suggest its restoration to a place among the stimulant beverages, and to inquire into its possible economic value.

I have been able to trace its use as a beverage back to the legendary migration of the Creeks from their supposed far western home to the seacoast of the Carolinas. Whether it was used by the prehistoric mound builders is a question which may not at present be solved. But some archæologist of the future may find in the remains of the mound-builders or their predecessors proof of its use among them.[2]

The leaves and young tender branches were carefully picked. The fresh cassine was gathered at the time of harvest or maturity of the fruits, which was their New Year. The New Year began with the "busk," which was celebrated in July or August, "at the beginning of the first new moon in which their corn became full eared," says Adair. The leaves were dried in the sun or shade and afterwards roasted. The process seems to have been similar to that adopted for tea and coffee. The roasting was done in ovens, remains of which are found in the Cherokee region, or in large shallow pots or pans of earthenware, such as the Indian tribes made.

These roasted leaves were kept in baskets in a dry place until needed for use. Loudonniere (1564) writes of being presented with baskets filled with leaves of the cassine.

Was it an article of commerce? There seems to be no doubt on this subject. Allusions to the drinking of the "black drink" are found, indicating its use among tribes residing at a long distance from the habitat of the cassine.

Lawson (1709) writes of its being "collected by the savages of the coast of Carolina, and from them sent to the westward Indians and sold at a considerable price." Dr. Porcher, author of the "Resources of the South," says: "The Creek Indians used a decoction of the cassine at the opening of their councils, *sending to the seacoast for a supply*," and adds that the coast Indians sent it to the far west tribes. How far its use extended northward, I cannot ascertain. From some allusions of the early French writers, I think it was used by the Natchez, and that it was sent up the Mississippi from the coast of Louisiana. The Indians of Wisconsin, Illinois, and westward, used a decoction of willow leaves as a beverage, but I cannot find that they used it in ceremonials, or that it was looked upon with the same reverence.

It appears from the accounts of various early writers that there were several methods of preparing the black drink.

(1) The decoction made of the fresh leaves and young branches.

(2) A decoction of the dried and roasted leaves. It is probable that the leaves during roasting developed new qualities, as the roasting of coffee brings out the aromatic odor due to a volatile oil.

(3) A decoction which was allowed to ferment. In this condition it became an alcoholic beverage, capable of causing considerable intoxication, similar to that caused by beer or ale.

The early history of the use of *Ilex cassine* as a beverage is lost in the darkness of prehistoric ages. Probably the same can be said of tea, coffee, maté, and cocoa. But it is a singular fact that while all the latter beverages still continue to be used in the countries where they are indigenous, as well as all over the world, the use of cassine is nearly extinct, as it is now only used occasionally in certain important religious ceremonies by the remnants of the Creek Indians, and will disappear with them unless rescued by chemical research and its use revived for hygienic or economical reasons.

The very earliest mention of cassine was made in the "Migration Legend of the Creek Indians." This curious legend has been lately published by A. S. Gatschet of the Bureau of Ethnology, Washington, D.C., with text, glossaries, etc. In his preface he says: "The migration legend of the Kosihta tribe is one of the most fascinating accounts that has reached us from remote antiquity and is mythical in its first part." This tribe was a part of the Creek nation. Its chief, Tchikilli, read the legend before Governor Oglethorpe and many British authorities in 1735. It was written in red and black characters (pictographic signs) on a buffalo skin. This was sent to London, and was lost there; but, fortunately, a text of the narrative was preserved in a German translation.

It begins by narrating that the tribe started from a region variously supposed to be west of the Mississippi, or in southern Illinois, or southern Ohio. They travelled west, then south, then south east, until they reached eastern Georgia. Here they met a tribe, called in the legend the "Palachucolas," who gave them "black drink" as a sign of friendship, and said to them, "Our hearts are white, and yours must be white, and you must lay down the bloody tomahawk, and show your bodies as a proof that they shall be white."

This was evidently the first knowledge the Kosihta tribe had of this beverage.

The black drink made by the Seminoles is described as "nauseous to the smell and taste, and emetic and purgative." It is a mixture and not brewed of the cassine alone. All our beverages, such as tea, coffee, maté, and even chocolate, when drunk very strong, are capable of causing diuresis, purging, and vomiting.

[1] Abstract of Bulletin No. 14, U. S. Department of Agriculture, Division of Botany, Edwin M. Hale, M.D., Chicago, Ill.

[2] This was written before Professor Venable's recent investigations.

One peculiarity of the drinking of the black drink is that, so far as I can ascertain, it was not used at their meals as we use tea and coffee, but wholly as a social beverage or at festivals and other public occasions. I do not think the women were allowed to drink it, at least not publicly. Authorities differ on this point.

Among the Creeks the women sometimes prepared the black drink, but Narvaez writes that the Indians on the coast of what is now Texas did not allow a woman to come near it during its preparation.

That a beverage containing caffeine should fall into disuse and become almost forgotten is a singular fact. The use of maté has not decreased from the time of the conquest of South America by Europeans. The reason why the latter is still in use and the former not lies, perhaps, in the fact that the Europeans in South America mixed with the natives, married, and adopted their customs, while the English and French who settled the Gulf States did not associate with the Indians, and adhered to the use of Chinese tea. Now that we know that the leaf of the cassine contains caffeine or theine, can its use as a beverage be revived?

It is not as pleasant in odor and taste as *Thea sinensis*, and this may be against it; on the other hand, it seems to have some salutary properties which the latter does not possess, and may, perhaps, be far more cheaply obtained.

A rough estimate can be made as to the number of square miles upon which it grows. Estimating the coast line from the James River, in Virginia, to the Rio Grande, in Texas — about 2,000 miles — and multiplying this by 20 miles, the extent of its growth inland, we get a total of about 40,000 square miles. On this area could be picked an immense quantity of leaves, and if the trees are not destroyed in the picking the crops could be harvested every year. No estimate can be approximated even of the amount of the crop of leaves which could be gathered, because we can not estimate the number of trees on this area.

It would seem possible that further inquiries on this point and careful experiments in cultivation and manipulation might result in furnishing our market with a product which would be found in many cases an acceptable and useful substitute for the more expensive imported teas.

LETTERS TO THE EDITOR.

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

On request in advance, one hundred copies of the number containing his communication will be furnished free to any correspondent.

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

Rain-Making by Concussion in the Rocky Mountains.

IN connection with the recent discussions of the effects of explosions in producing rain, it ought to be noted that for twenty years or more the Rocky Mountains have afforded excellent opportunities for observing the effects upon rainfall of heavy explosions at high elevations. There are in this region thousands of mines, mining claims with open cuts and adits, and quarries at elevations from 5,000 to 13,000 feet. Nitro-glycerine preparations are now the explosives used in blasting. During the summer there is a great amount of blasting high on the mountains. Several railways and wagon roads reach 9,000 to 12,000 feet, and the grading of these afforded much blasting. I have made considerable inquiry and found no one who had observed any connection between the explosions and rain-fall. Probably few or none were especially on the watch for such connection, but if there were any very obvious connection it would have been observed, since there have been so many years of opportunity.

About two years ago the cog-wheel road was graded to the top of Pike's Peak. Thinking that explosions on a high isolated mountain, rising far above the adjacent country like Pike's Peak, would produce rain if anywhere, I especially noted the weather. Tremendous explosions occurred daily for some months. The reports were often heard 30 to 40 miles, and many of them were at elevations between 13,000 and 14,147 feet. Yet all this happened in one of the dryest years ever known in Colorado, when often for days or weeks there was no precipitation even on the mountains.

G. H. STONE.

Colorado Springs, Jan. 12.

Rain-Making.

IN *Science* for Nov. 27, 1891, appeared an article from the pen of Professor Lucien I. Blake of the State University of Kansas, entitled "Can We Make it Rain?" in which some suggestions are made as to the proper method of conducting experiments to that end, drawn from the discoveries of Mr. John Aitken of Scotland, who has shown that unless there be dust particles in the air the aqueous vapor therein contained will not, in condensing, form itself into drops. Professor Blake argues from this that, instead of using guns or apparatus for producing terrific noises, the better way would be to send up inexpensive fire balloons carrying impalpable powders, which could be thus scattered through the air; or else carrying sulphur or gun-powder, the smoke of which, when they were ignited, would furnish the dust particles, which, it is assumed, are the only requisites for artificially setting in motion the process of nature that brings rain.

The reasoning of Professor Blake in leading up to this conclusion and in combatting the idea that concussion is a necessary factor in artificial rain production, contains much that appears sound from the standpoint of both science and good sense, and yet much that will not bear examination. His contention that thunder does not, to any extent, cause condensation of vapor, but is rather the result of it, is one which I have always held to, for latent heat is given out by condensing vapor, and this heat may appear in the form of electricity, and cause the lightning-flash that makes the thunder. The idea, also, that powder smoke may be a factor in rain production when rain is caused by a battle, is a logical deduction from Mr. Aitken's discovery. Professor Blake also avoids the blunder committed by Professor Simon Newcomb, in his article in the October number of the *North American Review*, where the latter lays himself open to the imputation of being himself guilty of the very thing he charges against the advocates of the concussion theory, viz., of "ignoring or endeavoring to repeal the laws of nature." This he does by asserting that ten seconds after the sound of General Dyrenforth's last bomb had died away "everything in the air — humidity, temperature, pressure, and motion — was exactly the same as if no bomb was fired," thus abolishing at one stroke the principle of the conservation of forces. Professor Blake, with less zeal but greater wisdom, practically admits that the forces brought into action by explosions are resolved into heat, and he does not, like Newcomb, annihilate this heat, though unwilling to admit that it can do work. Professor Blake also has the good sense to recognize the fact that the question of artificial rain production cannot be settled by laboratory experiments — a thing that cannot be said of all the assailants of the concussion theory.

But his contention that if concussion causes rain "the greatest effect — the practical effect — must follow close upon the concussion," cannot be sustained. While I reserve for a more extended article to be published elsewhere a full consideration of this question, I will here say, briefly, that the well demonstrated theory of the late Professor M. F. Maury that there are two great atmospheric currents, the equatorial and the polar, flowing above us in nearly opposite directions, furnishes the basis for a perfect explanation of the reason why the centre of the atmospheric disturbance caused by a battle should remain in the vicinity of the battle-field while the two currents are mixing together and initiating the process that leads to rain — a process which, it is plain, must require time in reaching a state of effective action.

But these points in the discussion are not so much what I desire to consider at this time as the special method recommended by Professor Blake for conducting rain-making experiments. The advocates of the concussion theory welcome any discoveries that can add to our knowledge of the reasons why battles cause rain, and thus suggest methods for producing it which may be an improvement on these suggested by the battles and their sequences. In this category appears to be the discovery of Mr. Aitken referred to, but it furnishes nothing conclusive on the subject, and, in my opinion, an experiment on the line marked out by Professor Blake would prove a failure. If some of us go to one extreme in relying too much on concussion as the means by which the process of nature that leads to rain can be set in motion, so does Professor Blake go to the other extreme in holding that it is smoke or dust particles alone that can artificially effect that result. We know, as a matter of fact, that simply throwing smoke into the air does not produce rain. There are scores of cities in our land whose chimneys are doing this every day, and yet they do not produce rain. And it cannot be said that the smoke they send up is not of the right kind. It contains a great deal of sulphur and of carbon, and these, according to Prosessor Blake, are among the substances which form dust particles, around which molecules of aqueous vapor most readily collect.

In the light of Mr. Aitken's discovery, however, I am willing to admit the possibility that smoke may not be without its effect in producing the rain that follows battles — an idea, I may add, which, though not original with me, I placed on record over twenty years ago, as may be seen by reference to the letter of Gen. Robert A. McCoy, in the appendix to "War and the Weather." In any future experiments in the field the application of the principle discovered by Mr. Aitken ought to be duly tested. But I see no reason as yet for doubting that force, exerted by means of explosions and expended on the earth and air, is a necessary factor in artificial rain production.

EDWARD POWERS.

El Paso, Tex., Jan. 15.

Eye-Habits.

IN *Science* of Dec. 18, 1891, p. 339, is a note taken from *Nature*, and referring to some experiments of Mr. James Shaw to test the ability of school children to keep one eye open and the other shut at the same time. Having been associated with school children for many years where the microscope was frequently used in the class-room for demonstration, my attention has often been called to their proceedings in this respect, and the impressions may be worth recording, though they are, no doubt, essentially like those of many other teachers in analogous positions. As the use of the microscope was only for a short time to each individual in a particular exercise, it was necessary that an observer looking into the tube of a monocular should by some means close one eye in order that other objects might not be in the field of view of the unoccupied eye and confuse the image. For it requires long practice on the part of one using a monocular stand to examine an object while keeping both eyes open and not be inconvenienced, a training out of question with school children where the time was limited. In the case of such the eye was closed either with or without the use of the hand. Being pupils in a high school their ages ranged from fourteen to twenty or more, the majority from fifteen to eighteen. Statistics were not kept, but I do not recall an instance where a boy could not close one eye without the aid of the hand. If it occurred, it was very rare. But it was quite common for girls to make use of the hand for this purpose, a fourth or more, as mentioned by Mr. Shaw for school children.

Sometimes, by request of teachers in primary grades, I have taken a microscope to their rooms, in which the lowest classes were taught, their ages being from six to eight or nine. It was for the purpose of showing something which the teachers desired to use as an object-lesson, like the eye or foot of a fly, or the scales from the wing of a butterfly, things whose forms they readily comprehended, as was shown by their description of them. With them the unaided closing of one eye was exceptional, some of the older boys, perhaps, being able to do so. I have noticed the same difficulty with older people who occasionally look through a microscope; the inability to shut one eye and leave the other open being among the women. This was illustrated but a short time since by a lady nearly eighty years old. She had recently had one eye treated for cataract, and was told to test the perceptive power of it. In order that there might be no interference by the other eye, this was covered by the hand.

This habit of peeping, or looking with one eye open and the other closed, is plainly an acquired one, becoming easy by practice, as is seen by comparing children with adults, and men and women with each other. The difference in the latter is mostly due to the lack of use. Boys early become accustomed to "sighting" in various ways in their play, as in the use of the cross-bow or bow and arrow, toy gun or real gun, or they may wish to line something. They also work more with tools, and, like a carpenter, must see if they are making a straight edge, and thus acquire this ability. There being less occasion for it on the part of girls and women, they may fail to gain it at all. This is not from inherent inability any more than in the case of men, unless heredity becomes a factor working through sex, and facilitating the process.

E. J. HILL.

Englewood, Chicago, Jan. 14.

BOOK-REVIEWS.

Chambers's Encyclopædia. New edition. Vol. VIII. Peasant to Roumelia. Philadelphia, Lippincott. Royal 8°. $4.

COMMENT on this encyclopædia may seem almost superfluous, not only because the work is well known, but also because of the uniform excellence of its several volumes; yet one does not like to pass it by without remark. The present volume is noteworthy for the number of its articles on philosophical and religious topics; Professor Andrew Seth writing on Philosophy, Professor D. G. Ritchie on Plato, Professor Sorley on Psychology, Mr. James Oliphant on Positivism, Professor Fliut on Religion, Rev. W. L. Gildea on Roman Catholicism, Professor Cheyne on the Book of Psalms, etc. In the very different department of the industrial arts we find articles on Photography, by T. C. Hepworth and W. T. Bashford; on the Plough and the Potato, by James MacDonald; on Pottery, by James Paton; on Printing, by John Southward; and a long one on Railways, by E. M'Dermott. In science strictly so called, Professor Peile treats of Philology, Mr. Norman Wyld of Plants and of Physiology, Professor Knott of Quaternions, Dr. Alfred Daniell of Reflection and Refraction Mr. J. A. Thomson of Protoplasm and of Reproduction; while the minor articles are too numerous to mention. In history and geography the most important papers are perhaps those on Phœnicia, by Canon Rawlinson; on Rome, by Canon Taylor and Dr. Steele; and on Persia and Persepolis, by Gen. R. Murdoch Smith. In this department it seems to us that there is a deficiency of maps. Political and social themes receive their share of attention, Mr. T. Kirkup treating of Political Economy, Mr. Jesse Collings of Peasant Proprietors, Mr. W. C. Smith of the Poor Laws, Sir E. F. Du Cane of Prisons, and Mr. W. Draper Lewis of Protection. Literature and the ideal arts are less conspicuous in this volume than in some of the previous ones; but Mr. Edmund Gosse writes of Poetry, Mr. Stead of Periodicals, Sir Joseph Crowe of Raphael, Mr. P. G. Hamerton of Rembrandt, and Mr. W. Holman Hunt of Pre-Raphaelitism. The number of minor articles on all subjects is so great as to preclude all mention of them individually; yet it not unfrequently happens that these are the most useful of all to the reader It is expected that the two remaining volumes of the Encyclopædia will appear during the present year.

AMONG THE PUBLISHERS.

THE new volume of the Badminton Library, announced by Little, Brown, & Co. for immediate publication, will treat of skating, curling, tobogganing, and other out-door sports. It is written by J. M. Heathcote, C. G. Tebbutt, T. Maxwell Witham, and the Rev. John Kerr, Ormond Hake and Henry A. Buck, and contains several plates and numerous illustrations in the text, by C. Whymper and Captain Alexander.

— John Wiley & Sons announce as in preparation "Elementary Lessons in Heat," by Professor S. E Tillman, United States Military Academy, and "Elementary Course in Theory of Equations," by C. H. Chapman, Johns Hopkins University.

— A. Lovell & Co., New York, have begun the publication of a series of American History Leaflets, to be issued bi-monthly. The first contains Columbus' letter to Luis de Sant Angel, announcing his discovery.

— Houghton, Mifflin, & Co. have just published the third volume of Sargent's important work on the Silva of North America. It will include Anacardiaceæ-Leguminosæ, and, like the previous volumes, will contain fifty plates drawn and engraved with the utmost skill.

— Charles H. Sergel & Co. announce a series of histories of the Spanish-American Republics. The first volume, which will be issued in February, will be "Peru," by Clements R. Markham. It will be followed in a short time by "Brazil," by William E. Curtis. "Argentine," by the Author of "An Earnest Trifler," and other volumes will be issued at intervals of two or three months.

— Longmans, Green, & Co. have published a small atlas prepared by Professor A. B. Hart of Harvard University and entitled "Epoch Maps Illustrating American History." It is primarily designed as a companion to the series on "Epochs of American History" published by the same house, of which Professor Hart is the editor. The author says that it is "an attempt to make maps from the records — from the texts of grants, charters, and governors' instructions, and from statutes, British, colonial, state, and national." It opens with a map showing the physical features of the United States, followed by several illustrating the early discoveries and settlements, and others showing the growth of the national territory, the settlement of disputed boundaries, the growth and abolition of slavery, the civil war, and various other phases of our national history. There are, however, no maps of particular regions of special historical importance, such as New Jersey in the Revolution and Virginia in the civil war — an omission that is to be regretted. But the maps that are given are excellent, and as history without maps is almost unintelligible, they will be useful to historical students.

J. B. Lippincott Company have just published a second edition of Goubaux and Barrier's "The Exterior of the Horse," translated by Dr. Simon J. J. Harger of the University of Pennsylvania. This edition has been in preparation for three years, involving many alterations, which in most cases amounted to almost a transformation of the old text into entirely new matter. A new plate upon the age, by G. Nicolet, and fifty-three original figures have been added, making the total 346 figures and 34 plates.

— Benjamin Sharp, Ph.D., will tell in the February *Scribner* some results of his Greenland explorations last summer. He describes what Sir John Ross, who discovered them in 1813, called

CALENDAR OF SOCIETIES.

Philosophical Society, Washington.

Jan. 16. — W. J. McGee, The Gulf of Mexico as a Measure of Isostasy.

Society of Natural History, Boston.

Jan. 20. — Charles V. Riley, Life-History of Sphecius Speciosus, Drury; Notes on Caprification; S. H. Scudder, The Tertiary Weevils of North America.

Chemical Society, Washington.

Jan. 14. — Officers were elected: President, Dr. T. M. Chatard; vice-presidents, Dr. F. P. Dewey and Mr. W. H. Krug; treasurer; Dr. E. A. von Schweinitz; secretary, Dr. A. C. Peale. The following were elected additional members of the executive committee: Professor F. W. Clarke, Professor H. W. Wiley, Mr. Cabell Whitehead, and Professor R. B. Warder. The following papers were read: H. W. Wiley and K. P. McElroy, Midzu-Ame; W. F. Hillebrand, Zinc-Bearing Spring Waters from Missouri.

Appalachian Mountain Club, Boston.

Jan. 13. — Herbert Dyer, Camping in the Highest Sierras.

Wants.

Any person seeking a position for which he is qualified by his scientific attainments, or any person seeking some one to fill a position of this character, be it that of a teacher of science, chemist, draughtsman, or what not, may have the 'Want' inserted under this head FREE OF COST, *if he satisfies the publisher of the suitable character of his application. Any person seeking information on any scientific question, the address of any scientific man, or who can in any way use this column for a purpose consonant with the nature of the paper, is cordially invited to do so.*

WANTED.—(1) A white man versed in wood and iron working, able to work from specifications and plans, suited for an instructor of boys; his business to have charge of shops of school, outline and direct the work for foremen and students; salary to be $1,000 per annum (nine months). (2) A man (black preferred) to teach the colored, iron working and forging, subordinate to the preceding; salary, $720. (3) A man (white) competent to take classes in engineering (assistant's position), but with the ability to perform any of the work required in any of the ordinary engineering courses of our universities; salary from $1,000 to $1,500. A. H. BEALS, Milledgeville, Ga.

WANTED.—Two or three efficient computers with good knowledge of Spherical Trigonometry and ready use of logarithms, for temporary employment in the office of the Coast and Geodetic Survey. Applicants should furnish evidence of their fitness for the work. Apply by letter to the Superintendent, Coast and Geodetic Survey, Washington, D C.

WANTED.—*Science*, No. 178, July 2, 1886, also Index and Title-page to Vol. VII. Address N. D. C. Hodges, 874 Broadway, New York.

A YOUNG MAN (31) would like a position in a college, laboratory, or observatory, is also willing to assist at a steam engine, etc. Address J. W., care of *Science*, 874 Broadway, New York.

WANTED.—A position in the philosophical or pedagogical department of a college or university by a young man (30) who has had five years' practical experience in teaching, and who has done four years' post-graduate work in philosophy, devoting his attention during the last two years especially to study and original investigation in scientific psychology and its applications in education. Address E. A., care *Science*, 874 Broadway, N. Y. City.

WANTED.—A suitable position in Washington, D. C., not connected with the Government, and with a salary not to exceed $650 a year, by an experienced biologist with six years' university training. Applicant has been a skilful surgeon for fourteen years; is a practical photographer, cartographer, and accustomed to the use of the typewriter. He is also capable of making the most finished drawings, of any description, for all manner of illustrative purposes in science; trained in museum methods and work; also field operations and taxidermy in its various departments, and modeling, production of casts, restorations of paleontological specimens and similar employments. Address U. S. R., care *Science*, 47 Lafayette Place, N. Y.

Exchanges.

[Free of charge to all, if of satisfactory character. Address N. D. C. Hodges, 874 Broadway, New York.]

Wanted to buy or exchange a copy of Holbrook's North American Herpetology, by John Edwards. 5 vols. Philadelphia. 1842. G. BAUR, Clark University, Worcester, Mass.

For sale or exchange, LeConte, "Geology;" Quain, "Anatomy," 2 vols; Foster, "Physiology," Eng. edition; Shepard, Appleton, Elliott, and Stern, "Chemistry;" Jordan, "Manual of Vertebrates;" "International Scientists' Directory;" Vol. I. *Journal of Morphology;* Balfour, "Embryology," 2 vols.; Leidy, "Rhizopods;" *Science*, 18 vols., unbound. C. T. McCLINTOCK, Lexington, Ky.

For sale.—A 6½ x 8½ Camera; a very fine instrument, with lens, holders and tripod, all new; it cost over $40; price, $25. Edw. L. Hayes, 6 Athens street, Cambridge, Mass.

To exchange Wright's "Ice Age in North America" and Le Conte's "Elements of Geology" (Copyright 1882) for "Darwinism," by A. R. Wallace. "Origin of Species," by Darwin, "Descent of Man," by Darwin, "Man's Place in Nature," Huxley, "Mental Evolution in Animals," by Romanes, "Pre-Adamites," by Winchell. No books wanted except latest editions, and books in good condition. C. S. Brown, Jr., Vanderbilt University, Nashville, Tenn.

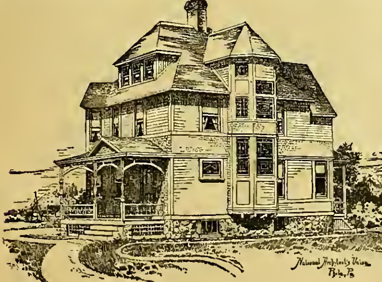
For Sale or Exchange for books a complete private chemical laboratory outfit. Includes large Becker balance (200g to 1-10mg), platinum dishes and crucibles, agate motors, glass-blowing apparatus, etc. For sale in part or whole. Also complete file of *Silliman's Journal*, 1862-1885 (62-71 bound); Smithsonian Reports, 1854-1883; U. S. Coast Survey. 1854-1869. Full particulars to enquirers. F. GARDINER, JR., Pomfret, Conn.

For exchange or sale at a sacrifice, an elaborate microscope outfit. Bullock stand; monocular objectives, one-sixth homogeneous immersion, four-tenths, and three inch, Bausch & Lomb. also one-fourth and one inch Spencer. Four eye-pieces. Objectives are the best made. Address Mrs. Marion Smith, 41 Branch Street, Lowell, Mass.

the "Arctic Highlanders," an isolated race of two hundred souls, which at the present time has about the same numbers as when first discovered. The author says: "Government they seem not to have, the oldest man of the family at most ruling that family. Of the customs, as marriage and religion, little or nothing is known, but we hope that the investigations of Lieut. R. E. Peary, who is now among these people, will throw much light upon this interesting chapter of their story." The results of these investigations will appear in *Scribner's*.

— A translation of the new book by the famous Egyptologist, G. Maspéro, entitled "Life in Ancient Egypt and Assyria," is to be published immediately by D. Appleton & Co In this work the author does not present a dry history of dynasties, but he gives a picture of actual life in its various phases among the two most civilized nations which flourished before the Greeks. Life in the city streets, in the huts of the poor and the palaces, marriage ceremonies, funeral and religious rites, hunting scenes, and battles, are all reproduced. The numerous illustrations by M. Fancher-Gudin are worthy of the importance of the book. As the author says, "It is the Egyptian and Assyrian himself that these illustrations show us, and not those caricatures of Egyptians and Assyrians which are too often seen in our books." Of this book the London *Academy* says: "It fills a real gap. It is fortunate that this new way of treating the materials supplied by the papyri, the cuneiform tablets, and the monumental remains of Egypt and Assyria was not earlier attempted by another hand, for who could have treated that material with the ease, the mastery, and the vivacity of M. Maspéro?"

— It has been known for some time past that M. Ernest Renan was engaged in writing a volume of reminiscences. The book is now finished, and by arrangement with the author will soon be published by the Cassell Publishing Company under the title "Recollections, Letters, and Addresses." The translation has been done by Miss Isabel F Hapgood.



SCIENCE

A WEEKLY NEWSPAPER OF ALL THE ARTS AND SCIENCES.

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CONTENTS.

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QUERY.

Can any reader of *Science* cite a case of lightning stroke in which the dissipation of a small conductor (one-sixteenth of an inch in diameter, say,) has failed to protect between two horizontal planes passing through its upper and lower ends respectively? Plenty of cases have been found which show that when the conductor is dissipated the building is not injured to the extent explained (for many of these see volumes of Philosophical Transactions at the time when lightning was attracting the attention of the Royal Society), but not an exception is yet known, although this query has been published far and wide among electricians.

First inserted June 19. No response to date.

N. D. C. HODGES,
874 BROADWAY, NEW YORK.

CALENDAR OF SOCIETIES.

Biological Society, Washington.

Dec. 26. — F. H. Knowlton, A Fossil Bread Fruit Tree from the Sierras of California; Lester F. Ward, Alphonse de Candolle on the Transmission of acquired Characters; B. T. Galloway, A New Pine Disease; C. Hart Merriam, Remarks on the Affinities of the North American Squirrels, Chipmunks, Spermophiles, Prairie Dogs, and Marmots.

Jan. 23.—C. W. Stiles, Notes on Parasites, Myzomimus gen. nov.; Theodore Holm, Studies of the Morphological Identity of the Stamens; Theobald Smith, On Peculiar Forms of Red Corpuscles in Mammalia in Anæmic Conditions.

American Academy of Political and Social Science, Philadelphia.

Jan. 26.—Charles DeGarmo, Ethical Training in the Public Schools.

SCIENCE

NEW YORK, JANUARY 29, 1892.

THE AMERICAN ASSOCIATION OF INVENTORS AND MANUFACTURERS.

Few occurrences of public interest have recently taken place which have been of greater moment to the people and to the nation as a whole, and few have attracted less public attention than that which was held in Washington in answer to the call of Mr. Watkins, on the 19th of January, — the meeting of the American Association of Inventors and Manufacturers. Organized a year ago, nearly, and composed of inventors like Dr. Gatling, Mr. Charles F. Brush, E. E. Sickles; business men like Mr. Gardiner G. Hubbard and Oberlin Smith; public men like General Butterworth and O. T. Mason; and scientific men like Professors Anthony and Thurston, and backed by the Commissioner of Patents, this association should have some interest for the people at large and for the journalists who represent the people. Its first meeting was opened by the president and attended by the whole bench of the Supreme Court, and its addresses during its several days' sessions were given by the most distinguished men of science and greatest inventors of the country.

The purposes of this organization are declared to be: To promote the progress of science and useful arts (Constitution U. S., i., 8). The diffusion of practical, scientific, and legal information respecting inventions. The encouragement of favorable and the discouragement of unfavorable laws respecting property in patents. To secure the co-operation of foreign inventors for reciprocal regulations under patent systems. The proper, just, and adequate protection of the rights of American inventors authorized by the Constitution of the United States. Any person in sympathy with the objects of the association is eligible to membership under conditions stated in the constitution upon the payment of a membership fee of five dollars for the first year. No initiation fee is charged. To the executive council, composed of the seven officers and the nine directors of the association, has been assigned the duty of completing the organization, begun with so much earnestness at Washington.

Its first meeting was held on the centennial of the signing by George Washington of the first patent law of the United States, the beginning of national industrial prosperity. As is well said in the call lately issued for the second meeting: —

"The celebration of the beginning of the second century of our American patent system was the outgrowth of a spontaneous desire to recognize publicly the benefits which that system has conferred upon our nation and upon the world.

"Eminent inventors, statesmen, and scholars from all parts of the Union met together to express their appreciation of the merits of that system, which has lightened the toil of the farmer, shortened the working hours of the mechanic, added to the safety of the miner, and lifted the burden from the household drudge.

"The monument then erected on the boundary line between two centuries, embellished by the best thoughts of such gifted minds, will endure so long as the libraries of the world shall preserve the record of their tribute to American genius.

"While existing laws have encouraged and do now stimulate the creation of intellectual property and do throw safeguards around its ownership, yet the fact remains that neither the real inventor nor the author has been adequately protected in his rights.

"This state of affairs has resulted from the fact that the inventors of the country have never thoroughly organized themselves for mutual protection nor brought concerted effort to bear upon their representatives in Congress, to the end that proper laws should be enacted, nor have they heartily supported the officials of the Government in their attempts to secure adequate facilities for carrying out present regulations. Hence the system, even as it exists, has been preserved with great effort, and even now is handicapped by some conditions that are not encouraging.

"It may be true that the patent system, in a few instances, has had an unfavorable effect upon certain sections of the country and upon some occupations, and that some owners of useful patents have demanded greater profit for their inventions than was consistent with the public good. But such evils, if they exist, can best be remedied by intelligent discussion among those who have a vital interest in the things themselves.

"The people at large and their representatives need to be impressed with the fact that it is to the epoch-making inventions of the century that our country owes its high position among the civilized nations of the world."

The patent system so auspiciously inaugurated by the greatest and first of our presidents has been intermittently promoted and sometimes obstructed in its operation by that alternation in power of friends and enemies — or lukewarm friends — which so generally characterizes the action of a popular government, and that of the United States no less than those of minor countries. In its best estate, however, it has never done the best that it might for either the inventor or the nation. During the last few years, its operation has been shamefully embarrassed and the interests of the country have been greatly injured, while those of the inventor and his rightful claims upon the country have been no less seriously affected, in consequence of the utter neglect of this great department by Congress, and the refusal of the national legislature to provide it with respectable quarters and sufficient working force.

In many cases, applications of immense importance to the industrial interests of the nation have been kept in the office for many months, through the utter inability of the working force to keep itself up with the business of the office.

The annual report of the Commissioner of Patents to Congress dated Jan. 1, 1891, calls attention to the lack of sufficient examining force and to the need of more office room. The commissioner remarks that "the pace kept up in the patent office now, as in all recent years, is inconsistent with that high degree of care which the patent system calls for," and that "a patent should evidence such painstaking in examination that upon its face it should warrant a preliminary injunction, and there can be little doubt that the continuance of the 'American' examination system depends upon so conducting examinations into the novelty of alleged inventions as to make the seal of the patent office a powerful, if not conclusive, presumption that the patent is valid."

The commissioner further reports that "during the past year the patent office has earned a surplus, over every expense, of $241,074.92, and the total balance to the credit of the patent fund now in the treasury of the United States is $3,872,745.24, and that the inventors of the country cannot understand why the government takes their money and then fails to provide necessary facilities."

Such a state of affairs is simply a disgrace to the country and to the committees of Congress entrusted with the care of this great instrument of national advancement. The work of the association should be forwarded by every citizen and promoted by every journal in the land. The indifference of the members of the committees of Congress having charge of the business interests of the country can only be accounted for by the fact that the people, and especially the business men of the country, who should continually consult with and direct these committees, pay no attention to this branch of legislative work. Were these committees carefully made up of men well-posted in the work entrusted to them, and were they kept up to their duty by the pressure of public opinion, the prosperity of the nation would be vastly better assured than now.

SOME RECENT MINERAL DISCOVERIES IN THE STATE OF WASHINGTON.

WHEN I visited Washington Territory in the autumn of 1887, I found great activity among the prospectors in the mountainous region lying near the Canada line, and between the Cascade Range and the Bitter Root division of the Rocky Mountains; also in the Cœur d'Alene region. Many fissure veins carrying gold, silver, lead, zinc, copper, etc., had been discovered, and tested sufficiently to prove their richness. In some cases the precious metals were associated with iron carbonates, but more commonly with iron sulphides, galena, and lead carbonates. Chlorine, antimony, and zinc were also found in combination. Copper was found both native and combined. The gangue was usually quartz, with which is often associated what is called "porphyry." The country rocks are granite, quartzite, argilite, and limestone.

On my return to the country in 1891 (now the State of Washington) I found that there had been no loss of reputation in respect to any of the mining localities; but that in all except the Cœur d'Alene and Colville regions the development of ores had been retarded by the lack of transportation.

In 1887, the Cascade Range proper, though rich in the purest magnetite along its crest, and in the Cretaceous lignites along its flanks, was not regarded as a promising field for the discovery of the precious and base metals. A few small veins of low grade silver, gold, and copper ore had been found among the iron bearing rocks about the head springs of the Snoqualmie River, but nothing to compare with the developments on the waters of the Methow, Okinagane, Kootenai, Cœur d'Alene and upper Columbia, on the east of the Cascade Range. But during my visit to the State last autumn I found an army of prospectors and miners at work on a group of veins running along the western flank of the Cascade Range. This group or belt so far as discovered is about fifty miles long and fifteen miles wide (perhaps twenty miles wide), and occupies the eastern edge of Snohomish and Skagit Counties. The region is drained by the upper waters of the Skagit, Stillaguamish, and Skykomish Rivers. The veins are well-defined fissures carrying gold, silver, lead, copper, and sulphur with iron, antimony and arsenic in quartz and porphyry; in other words, the same sort of veins as those found in eastern Washington. Usually they follow the course of the country rocks, but with the usual branching and flexing.

The country rocks, which consist also of granite, quartzite, and slate (I saw no limestone) usually stand nearly vertical, though in some places inclining eastward with a dip as low as thirty degrees. The general trend of both country rocks and ore veins is a little more to the north-east than that of the irregular crest-line of the main mountain. Hence they all cross the mountain at a sharp angle immediately north of the Cascade Pass, the name given to the notch at the head of the Cascade River, which is one of the chief affluents of the Skagit River. This locality has within two years become famous as the "Cascade Mining District." Here have been opened numerous veins of auriferous pyrites and argentiferous galena. The veins are broken across by a deep gorge, whose steep sides are striped by the disclosed vertical edges of the veins. Of course, in many places the outcrops are concealed by soil and vegetation, but the mountains rise three to four thousand feet above the gorge (six to seven thousand feet above Puget Sound), and the upper third is bare rock, and numerous denuded spaces extend much lower. The physical conditions are favorable for prospecting, mining, concentrating, and moving. The mountain on the north side holds near its summit two small glaciers: the lower one I named the Silver Queen, the upper one the Skylight. Snow slides and running gravel are uncomfortably common on these heights. But safe camping ground can always be found in the evergreen forests on the mountain sides. So much for the north end of this mineral belt.

The other leading mining district is at the south end of the belt, and is known as the Silver Creek District on one side of a dividing ridge, and the Monte Cristo District on the other side. Silver Creek is a tributary of the Skykomish River, and has its head in Silver Lake, a beautiful little sheet of water nestling among the evergreens in a groove of one of the lofty outliers of the main range. The creek, after running in its elevated trough for two or three miles suddenly begins to pitch down a steep escarpment, and falls a vertical distance of two thousand feet in three miles of surface measurement, and falls fifteen hundred feet more in the next five miles, at the end of which it joins the north branch of the Skykomish River. Its course is southerly.

The Monte Cristo District is made by a continuation eastward of the veins of the upper half of the Silver Creek District, which pass through the water-shed into the valley of the Sauk River, a tributary of the Skagit. Taking this part of the mineral belt across its widest part it measures at least twelve miles, probably more. The ores do not differ materially from those of the Cascade River country, and the veins stand on each side of the gulches, offering every facility to the miner. Not less than thirty distinct veins (or ledges) have been uncovered, and many tunnels of several hundred feet in length have been driven horizontally. The best "rich streaks" are of argentiferous galena, which in a few cases are as much as four feet wide (generally much less), and carry from thirty to three hundred ounces of silver to the ton.

This new mineral region is as yet but very partially examined. It is, however, a permanent addition to the vast mining territory of the Rocky and trans-Rocky Mountain country, and when considered in connection with previous discoveries, it suggests the probability that the mineral deposits of the State of Washington exceed in quantity and value those of any other State.

W. H. RUFFNER.

Lexington, Va., Jan. 23.

THE EVOLUTION OF THE LOUP RIVERS IN NEBRASKA.

THE most casual inspection of a map of central Nebraska might suggest that the hydrography of the region has probably undergone radical changes. It looks as if the three Loup rivers, and the smaller creeks running parallel to them, had once been separate tributaries of the Platte, all independent of each other, as roughly indicated by the dotted lines on the map (Fig. 1). The Platte is the great central trunk of the drainage, and these streams all seem to be headed for it like branches, and would join it directly if they had not been somehow turned eastward and united to form the Loup River.

It is the fate of such impressions to fade out in the light of accurate knowledge, but there are some survivals, and this

FIG. 1.

bids fair to be one of them. I have, I think, verified it by field work, and I will briefly recount some of the topographic and geological data which tend to confirm the first impression.

The Loup rivers flow in channels excavated from fifty to two hundred feet in soft tertiary marls. Taking them in succession from south-west to north-east each stream is lower than the preceding one. A profile on a line at right angles to the general south-east course of all the streams of the Loup system, would have the general character roughly represented in Fig. 2.

This general north-east slant of the country gives a great advantage in rapidity of erosion to all ravines on the south-west side of each stream. They become longer, deeper, carry more water, and are cut down more rapidly than those on the north-east side of the next higher stream, because they run with the slope of the country and have a lower outlet. Thus the space between the streams is captured by the more vigorous headwater erosion of the north-easterly tributary. Presently a branch more vigorous than the rest captures the headwaters of its neighbor lying to the south-west. This imparts still greater vigor of attack, and the succeeding captures in the same direction are hastened.

The latest robbery in the Loup system is that of the headwaters of Wood River. Journeying down from the headwaters of the South Loup one is impressed with the apparent continuity of its valley with that of Wood River, rather than with that of the South Loup itself below Callaway. It is obviously an instance of the lower, more easterly stream cutting through the divide and drawing to itself the headwaters of the higher one.

This series of captures by lower tributaries is exhibited on a grand scale and in a mature form in the Loup system. Another example on a smaller scale, and in its incipient stages, is shown in Fig. 3. The streams a and b have each captured the headwaters of some streams lying westward, and a threatens to capture the headwaters of b.

In this case, on the Republican River, the slant of the country is directly east, and is due to the Rocky Mountain upheaval, which gave an eastward tilt to the great plains.

FIG. 2.

In the Loup region there is also, in addition to the eastward slope, a pitch to the north-east, which has a more local origin, but is, none the less, an important factor in the evolution of the Loup system. The last great tertiary lake (Cheyenne) submerged the Loup and the Republican completely, but left the upper Platte a vigorous mountain stream, bringing down silt at a rapid rate. This silt, quickly subsiding in the still lake waters, formed a succession of bars off the mouth of the river, as the shore line shifted east and west in the vicissitudes of climate, and of upheaval and subsidence. There was no permanent point of discharge, and consequently no permanent single bar, but a general distribution of silt in and along the channel of the Platte, which accumulated to such an extent as to raise the level of this river above that of the Loup on the north and the Republican

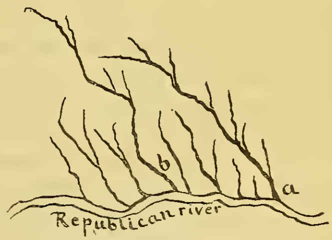

FIG. 3.

on the south. This is true in the case of the Loup, notwithstanding it is a tributary of the Platte, and the anomally is explained by the lower gradient of the Loup. The tributary is at the same level as the parent stream at the point of confluence, but the Platte falls 7.1 feet per mile and the Loup only 5.6 feet per mile. This brings the Platte rapidly above the Loup in following them upwards from the point of confluence. It is true that this lower gradient of the Loup is itself anomalous, so that I have only explained one anomaly by another. The full explanation of the second would require another article.

The natural result of excessive deposition along the Platte would be to crowd the mouths of its tributaries eastward and obliterate their old channels. Not only would they be turned to the east by the mass of silt in their former path, but they would be crowded upon each other and unite in a main trunk almost parallel to the Platte, like the lower Loup. The two causes, headwater erosion and Pliocene channel-filling, have worked together harmoniously. The former has swept the upper courses westward by a series of captures; the latter has crowded the mouths of the tributaries eastward and made them coalesce into a single large tributary. Thus a number of separate tributaries entering the Platte nearly at right angles have been wheeled into an oblique position, and evolved into one great tributary system, whose volume rivals that of the parent stream. L. E. HICKS.

NOTES AND NEWS.

A TELEGRAM has been received announcing the illness of the Right Rev. John J. Keane, D.D., president of the Catholic University of America, and requesting that the date on which his address, before the Brooklyn Institute, on "Leo XIII. and the Social Problems of the Day" is to be given be postponed until Bishop Keane is able to come to Brooklyn to deliver it.

— Those who interest themselves in the aboriginal languages of Australia, will hear with much satisfaction that the vernacular of the natives of the MacDonnell range, South Australia, has been studied and committed to writing by their missionary, Rev. H. Kempe, who resides on the Finke River mission. His grammar and vocabulary occupy the first fifty-four pages of the Transactions of the Royal Society of South Australia (Vol. XIV., Part I., July, 1891, 12mo), a periodical edited by Professor Ralph Tate, Adelaide, W. C. Rugby, publisher.

— On the 9th of January representative scientists from the different parts of the State met in Austin, at the University of Texas, and organized a Texas Academy of Science. The officers are: president, Dr. Everhart, professor of chemistry, Austin; vice-president, Mr. Dumble, state geologist, Austin; treasurer, Professor Nagle, Agricultural and Mechanical college, Bryan; honorary secretary, Dr. Macfarlane, professor of physics, Austin; members of council, Dr. Halsted, professor of mathematics, Austin; Mr. von Streeruwitz, State Geological Survey; and Dr. Simonds, professor of geology, Austin.

— At the late annual meeting of the Iowa Academy of Science Mr. R. Ellsworth Call exhibited a remarkable specimen of the human hyoid bone, taken from a male subject. The basi-hyal was excessively irregular on the anterior surface with complete obliteration of the median vertical ridge; the anterior aspect was also somewhat concave. The right cerato-hyal was entirely wanting; the left was nearly as long as the thyro-hyal on its side, and was styliform in shape. It was completely ankylosed to the basi-hyal. On the side on which the cerato-hyal was wanting there was no evidence of any structure corresponding to the cerato-hyal and no indication of a synovial bursa or structure which would show that it had ever existed. In addition, the muscles of that side were attached to the basi-hyal, and this was believed to be the cause of the disappearance of the vertical median ridge and the cause of the roughened characters presented by the anterior surface.

— The second annual meeting of the Nebraska Academy of Sciences was held at the University of Nebraska, commencing Thursday, Dec. 31, 1891. The programme was as follows: the president's address, Specialization in Science (Dr. Kingsley being absent, the address was read by Dr. C. E. Bessey); The Slime Moulds of Crete, by A. T. Bell; The Evolution of Oxygen by Plants, by A. F. Woods; Additions to the Flora of Nebraska, by by Professor G. D. Swezey; The Flora of the Black Hills, by Dr. C. E. Bessey; Metabolism, by Dr. H. B. Lowry; A Bacterial Disease of Corn, by H. B. Duncanson; Notes on the Flora of the Artesian Well at Lincoln, by J. R. Schofield. The officers for 1892 are: president, Dr. Charles E. Bessey, University of Nebraska, Lincoln; vice-president, Professor G. D. Swezey, Doane College, Crete; secretary, W. Edgar Taylor, State Normal School, Peru; custodian, Lawrence Bruner, University of Nebraska, Lincoln; trustees, Ex-Superintendent E. T. Hartley, Lincoln, and Dr. H. B. Lowry, Lincoln.

— In a paper presented to the Iowa Academy of Sciences, recently, Miss Minnie Howe, assistant in biology in the West Des Moines High School, described a series of experiments made by her at the Iowa State University during the winter and spring of 1891, together with their results. The problem which Miss Howe attempted to solve was the separation of the *Bacterium, Bacillus subtillis*, from the yeast plant *Saccharomyces cerevisiæ* found together in ordinary soft yeast. She sought, also, to obtain pure cultures of each and to determine the part that each played in bread-making. It was found that bread made of sterilized flour and raised with the pure bacillus culture was light, but not as spongy as ordinary bread, sweet, close-grained, rather dark-colored, smelling and tasting much like "salt-raised" bread. Bread raised with the pure yeast culture under exactly the same conditions as the first was somewhat light, sweet, not so fine-grained nor as light as either ordinary bread or that made with bacteria. It had a peculiar insipid taste, with an odor unlike that of either of the other kinds. The result of these experiments seems to show that neither the yeast plant nor the bacillus alone will make as good bread as both together; that either without the other will produce alcoholic fermentation and cause bread to rise; that the bacillus is rather more efficient alone than the yeast. Further experimentation is projected along the same line, since no one set of experiments can be regarded as conclusive.

— "The influenza is once more in the air," says the *British Medical Journal*, "wafted hither and thither throughout the habitable world, a formidable, disabling, and fatal pandemic. Once more we are urgently asked on all sides, 'Have we a specific? Can we offer a cure?' It is the old delusion and the everlasting and unreasoning, but excusable, impatience for the miraculous and the impossible.. 'Disease comes by Providence and goes by medicine;' that is a durable and popular formula. Of specifics for sale there are, of course, a legion. To sell them is the business of the quacks; the Matteis, the Holloways, the Morrisons abound in specifics. There are a dozen available for cholera, for typhoid, for small-pox, for hydrophobia, for carcinoma — all equally plausible and equally useless except for commerce — and why not for influenza? But is there a specific for any disease? It is more than doubtful. The more we know of the nature and cause of disease, of its origin and life-history, the less we are inclined even to expect the discovery of specifics. Disease we know not as an entity, an enemy to be struck down with a club, or to be expelled by a drug, but as a process, the change of tissues and of fluids, the growth of a microbe, the proliferation of a cell, the secretion of a virus. We can modify the processes, we can lessen their virulent products, we can fortify against their worst effects; we can aid the evolution and perhaps guide it to health; sometimes we can arrest it; and often we can anticipate it. Thus we know how to ward off many diseases. Cholera, typhoid, small-pox, hydrophobia are enemies whom we can meet at the gate and forbid their approach. Deaths from either of these preventable diseases are, for the most part, violent deaths, inflicted by the ignorance of the people, the neglect of the sanitary authorities. *Populus vult mori.* In their search for specifics they parley with the enemy and lose their lives. Of influenza we know less than of most other infections; it is aerial, communicable from person to person, and along the lines of travel. For it, as for scarlet fever, we have only isolation as a preventive and palliatives as a treatment. Perhaps one day we shall know more; but there does not seem any likelihood of the discovery of a specific, and judging from numerous analogies it is far from certain that there is in this any ground for reproach. At any rate, it comes badly from a public and from a generation which is content to leave Great Britain without even one Institute of Preventive Medicine, and which is left to an appeal for funds from a Lister and a Roscoe to found such an institute — in which lies a chief hope for further life-saving and the advance of preventive and curative knowledge — while millions are lavished on weapons of destruction, or the more obvious means of charitable relief to physical suffering; and finally on the purchase of fraudulent 'specifics.'"

— The Rain Convention at Millers, South Dakota, was largely attended, and as a result it is believed that twenty counties will accept the offer of a Kansas artificial rain company to produce rain during the crop season at $500 a county, on the understanding that if there is no rain there will be no pay.

— Professor S. Ward Loper, last year lecturer on biology and geology in Trinity College, Hartford, and later connected with the United States Geological Survey in Colorado, has been appointed assistant to the Board of Management of the United States Exhibit at the World's Fair. He will select and classify fossils.

— It is expected that the Spicer Library of the Brooklyn Polytechnic will be catalogued and opened for sudents by May 1. $10,000 had been expended for books and nearly 10,000 selected volumes have been placed upon its shelves, comprising the latest works in philosophy, law, history, science, and general literature. The entire cost of the new building, including land and equipment, has been estimated at $350,000.

— The next meeting of the New York Section of the American Branch of the Society for Psychical Research will be held at Room 10, Columbia College, Law Building, Wednesday, Feb. 10, at 8 P.M. Professor William James will preside. The programme will be as follows: 1. Routine business. 2. Address by Professor James, on the Census of Hallucinations. 3. Report of some experiments in automatic writing, by B. F. Underwood (to be read by R. Hodgson, secretary of the American branch). There will be no admittance except by ticket. Special tickets are sent for members and associates. Other tickets, each of which will admit three persons, will enable members and associates to introduce their friends. Extra tickets may be obtained by members or associates on application to the secretary of the section, J. H. Hyslop, Columbia College, New York.

— The New York *Tribune* states that among the many proposed additions to Columbia College is a new school, to be known as the School of Pure Science. The announcement has met with the approval of the many friends of the college. Up to the present time the greater part of the scientific work has been done under the direction of the faculty of the School of Mines. In the new school the course will be three years, and will lead to the degree of Doctor of Philosophy. A student in the School of Arts will be able to spend his senior year in that department, take the degree of A.B., and at the end of the second and third years, respectively, in the new school, take the degrees of M.A. and Ph.D. The faculty in the School of Pure Science will be made up principally of the teachers in the School of Mines. The college proper will name a department, in accordance with the recommendations of Professor Charles F. Chandler, dean of the School of Mines, where pure scientific research can be carried on.

— The floating of the particles of cloud or fog, Herr von Frank of Graz seeks to explain (*Nature*, Jan. 14) by the presence of an envelope of aqueous vapor. As an approximate average value for the diameter of droplet with envelope he gives 0.7 mm. Supposing one cubic metre of cloud to hold 3 grammes of water, there would be an interval of 0.2 mm. between the envelopes. When clouds pass over the sun, the shadows of objects are perceptibly lengthened when the darkening occurs, and the author attributes this to refraction by the vapor envelopes. Again, it is difficult to see how water droplets in the form of cloud or fog could exist at such various temperatures, did not the vapor envelopes, as bad conductors of heat (compare Leidenfrost's drops), guard the droplets to some extent from evaporating and freezing. The minute particles must soon be dissipated by the sun's rays, if they were not in a kind of spheroidal state. This heating expands the envelopes, so that the cloud tends to rise; and various phenomena in nature may be thus explained (e.g. the rise of mist in Alpine valleys). Once more, liquid droplets have been observed (by Assmann) floating in air of $-10°$ C°. On meeting a solid body these froze to ice-lumps without crystalline structure. Here, according to Herr von Frank, the vapor-envelopes prevent freezing till they are ruptured by the solid; the droplet thus loses the bad conductor of heat which protected it, and solidifies so quickly that no crystals can form. The author supposes that with much aqueous vapor in the air larger drops form, the clouds floating lower; with less aqueous vapor, the drops are smaller and the clouds higher; the thicknes of envelope, however, being the same for large and small drops under like conditions of temperature and pressure.

— A despatch to the New York *Tribune*, dated San Francisco, Jan. 24, states that H. W. Turner, a geologist of Washington, D.C., who for two years past, under the auspices of the California Division of Mining Geology, has been exploring the gold regions of the Sierras, arrived there the day before. Mr. Turner obtained from a gulch at Cave City, Calaveras County, a meteoric stone that will excite no little interest in the scientific world. It is almost as large as one's fist, and around a good portion of it is a solid film of gold. In one place the gold shows for about an inch square. Hitherto, in all discoveries, no meteoric iron has been found in connection with gold. "It demonstrates," Mr. Turner says, "that there is gold in the worlds of space from which meteoric iron has fallen. The specimen will be boxed and sent to Washington. Other pieces will probably be forwarded from Calaveras. I have examined it very carefully. It is extremely tough, and it is almost impossible to break it. In my opinion it has fallen from one of the stars. This demonstrates that there is gold in some of the stars, at least. I shall send this piece to the Smithsonian Institution."

— In the *Repertorium für Meteorologie* (Vol. XIV. No. 10), M. E. Berg discusses the frequency and geographical distribution of heavy daily rainfalls in European Russia, excepting Finland and the Caucasus. The observations, says *Nature*, refer to the years 1886–90. a rather short period; but in previous years there were not sufficient stations for such an investigation. The paper deals exclusively with falls of between 1.4 and 3 inches, distributed according to months, for the various governments of the empire. The results show that the frequency of heavy falls is subject to considerable fluctuation from year to year. The regions of greatest frequency occur on the south-east coast of the Crimea and the extreme south-west of the empire; on the eastern side of the Dnieper, the region extending to Smolensk and further northwards is also subject to very heavy falls. The northern limit of daily falls of over 3 inches, so far as relates to Central Russia, is the Government of Moscow. The yearly range of frequency reaches a maximum in summer, and, except in the south-eastern districts, the frequency in autumn is greater than in spring. In July and August the great falls extend over very large districts, and at other seasons are generally regulated by the course of the barometric depresssons. The following is the average yearly frequency of the heavy falls for the whole empire, arranged according to seasons: winter, 0.8; spring, 14.3; summer, 106.4; autumn, 20.8. The maximum amount which fell in any day was over 8 inches, in Bessarabia.

— Thomas Whittaker has just ready a second edition of St. Clair's "Buried Cities and Bible Countries," the work on Palestine exploration that was well received last fall.

— E. & F. N. Spon & Co. expect to have ready very shortly the second edition, revised and enlarged, of "The Maintenance of Macadamized Roads," by T. Codrington; also the second edition, revised and enlarged, of "The Municipal and Sanitary Engineer's Handbook," by H. P. Boulnois.

— The prospectus is issued of a *Forstlichnaturwissenschaftliche Zeitschrift*, an organ for laboratories of forest-botany, forest-zoology, forest-chemistry, agriculture, and meteorology. It is to appear monthly in Munich, under the editorship of Dr. Carl Freiherr von Tubeuf; the first number is announced for the current month.

— A work on the great earthquake of Japan, by Professor John Milne and Professor W. K. Burton, is now in the press at Tokyo. It will be illustrated by 25 large photo-plates. For the sake of comparison, there will be two plates showing on a small scale the effects of earthquake in Italy and other countries. All the plates are to be on the finest quality of Japanese paper.

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A RECENT ANALYSIS OF WILL.[1]

THE promise made by Professor Baldwin in the preface to his first "Handbook"[2] has been fulfilled. The expectation aroused by this promise has perhaps been more than gratified since in the "Psychology of Feeling and Will" we have the same rigorous scientific treatment which characterized the former volume, applied to subject matter which, for reasons now known to be suicidal, has been worked over for college text-books with far less care and satisfaction than the strictly intellectual operations. It must be a source of congratulation to teachers of psychology to know that we are now having given us year by year psychologies which deal with the stubborn complexities of mind from a standpoint that bids fair to give us soon, if it has not done so already, a veritable "New Psychology."

Taking the old method at its true worth and retaining the sum-total of valuable results it has given, it is still evident that the "natural science point of view" has been so fruitful in its construction of psychological data, has so modified old conceptions, has in fact so changed the whole face of psychological procedure, that nothing short of "New Psychology" can briefly characterize these consequences. The volumes of both James and Baldwin will, however, have their real value for teachers, not only as psychology, but as affording an ordered body of scientifically determined laws necessary for anything like fruitful philosophical construction. The data of philosophy must come from science as positive, and the scientific data given up by psychology are, it is clear, peculiarly valuable as a contribution to the conditions necessary for serious philosophizing. Rational interpretation, aided by "the judicious use of hypotheses," is necessary to complete the full survey of mind, but presupposes, if it is to be of genuine worth, previous empirical investigation. Upon such investigation is based "the possibility of a psychology, which is not a metaphysics, nor even a philosophy."

Written under this conception is Professor Baldwin's "Handbook." It is replete, however, with latent suggestions which take one immediately over into the philosophical field. Such suggestions when formally stated are to be found in the small print, which immediately follows the strictly psychological analysis and discussion.

Peculiarly rich in suggestion for ethical construction has seemed to me the author's discussion of "Will," and I desire, in brief review, to dissect out of the body of the analysis the facts which have ultimate bearing on the question of "Freedom." For whether solvable or insolvable in any ultimate sense on psychological grounds every one must admit that the weapons of analysis whereby the complex problem of "Free-Will" may be reduced to intelligible form are in the hands of psychology. Even if we reach no satisfactory solution, it is at least a gain to know clearly what the elements of the problem are. It is natural enough, therefore, that with every attempt to throw new light on the underlying elements of volition, the old sore of freedom should be reopened. As long as philosophy has life, an acknowledged fundamental question cannot remain passively unsettled; philosophy cannot be held in check by external prohibition; it moves with an inner life of its own.

Sidgwick recognizes this in his return to the question of freedom,[3] claiming, as he does, that, although "complete mutual understanding will never be reached until we have reached complete confutation of fundamental errors," yet "a diminution of the amount of misunderstanding . . . especially on fundamental points," is an end in itself worth striving for. What Professor Baldwin's discussion has accomplished in the interests of this desideratum of diminished misunderstanding, let us see.

Chapters xii. and xiii. discuss, under the general title of the "Motor Aspects of Sensuous Feeling," first, "the motor consciousness; second, the 'stimuli,' to involuntary movement." As a fundamental law of the motor consciousness we have stated what is called the law of mental dynamogenesis, viz., "that every state of consciousness tends to realize itself in an appropriate muscular movement." The general conclusion reached on the reactive consciousness is that this "consciousness, *per se*, is simply consciousness of nervous reactions and memories of such reactions or of their elements. As far as there is a consciousness of self in reflex attention, it is an objective felt self rather than a subjective feeling active self. Whatever ground may be found subsequently for such an active executive self, we find no such ground here" (pp. 293–4). This conclusion is corroborated by a reference to certain well-known hypnotic phenomena in which power of choice is wanting and the consciousness of the patient becomes entirely reactive.

Stimuli to involuntary movement are next analyzed and discussed. "By stimulus is meant the affective experience of any kind which tends to issue in conscious motor reaction" (p. 295). Such stimuli fall under one or the other of two great classes: (1) organic, (2) extra organic. In this connection (p. 204) is found the differentiation of stimuli as impulsive or instinctive. Sensuous impulse is "the original tendency of consciousness to express itself in motor terms as far as this tendency exists apart from particular stimulations of sense" (p. 307). On the other hand, "instincts are original tendencies of consciousness to express itself in motor terms in response to definite but generally complex stimula-

[1] "Handbook of Psychology: Feeling and Will," by James Mark Baldwin. Henry Holt & Co., New York.

[2] "Senses and Intellect."

[3] Mind, October, 1889.

tions of sense; i.e., they are inherited motor intuitions" (p. 311). Nor must it be forgotten that all these classes of stimuli have meaning for the reactive consciousness because they have a "feeling aspect." "An idea simply as an idea — if such could be realized — might not react in movement; but the simple presence of an idea in consciousness is itself a feeling, and only in as far as it affects us does it move us" (pp. 313–314). "Affects," therefore, is the expressive term to be applied to all stimuli to involuntary movement.

In chapter xiv., ideal feeling, in its motor aspects, is the subject of discussion. Here the stimuli have a characteristic wanting to those previously considered, viz., the element of intention. The "end foreseen" illuminates and directs consciousness in company with the ever-present stimulus of "interest." Professor Baldwin finds that "interest in an object," "emotional excitement," "idea-motor suggestion,"[1] "ideal pleasure and pain," are the general stimuli to voluntary movement. The genetic aspect of mental life — the organic connection of higher with lower in mental development—here finds illustration in the reappearance of "affects" as stimuli. In lines worth quoting we are told, that "the psychology which separates volition from reaction so sharply as to deny any influence upon the will to other stimuli than pictured ideas, is false. The conditions back of an act of choice are never limited to the alternatives between which the choice is made. There is beneath it all a dumb, unexpressed mass of affects — organic partially — felt tendencies outwards, which give coloring to the whole process" (pp. 319–320). This is interesting as a preliminary warning of the complexity to be met when we come to the fundamental problem of choice and its conditions; for it is complexity such as this which makes free-will the Gordian knot of moral philosophy. Analyze and elaborate what is known, as best we may, and there is yet left over a residuum of unreduced complexity sufficiently great to introduce a precarious element into our best results. To snatch certainty out of the hands of uncertainty, other considerations than those purely psychological may be necessary; it may be necessary, as in Professor James's case, to adopt a belief in freedom on ethical grounds. In the graphic language of James, "taking the risk of error on our head, we must project upon one of the alternative views the attribute of reality for us; we must so fill our mind with the idea of it that it becomes our settled creed."[2]

Passing by the analysis of "desire," with its ethical suggestions all along the line, we come to the author's definition of "motive," as "any influence whatever which tends to bring about voluntary action" (p. 332). Motives may be either ends or affects, while ends alone give definite lines of guidance where choice is made.

From the exploration of the springs of voluntary activity, the author passes to the nature of such activity, finding that it is always characterized by a feeling of consent or feeling of effort. All effort feeling is one of two kinds — either positive or negative: effort to do or effort not to do. Fiat of will is positive effort; neget, the negative. Three factors in the development of voluntary movement are stated: "(1) Voluntary attention to a presentation, which, in turn, stimulates a native muscular reaction; (2) voluntary attention to a presentation of movement, which stimulates the movement presented; (3) voluntary attention to an end for which a muscular reaction is a necessary means" (pp. 343–4). These come to light as a result of the analysis of the fiat and neget into their elements; and this examination gives ground for the important claim that "the entire question as to what volition is, is accordingly thrown back upon an investigation of the exercise of voluntary attention"[3] (p. 342).

Chapter xiii. introduces matter bearing from the very beginning more directly on the problem of freedom; the whole field is canvassed with a minuteness and comprehensiveness which makes the discussion a model of what psychological investigation should be. You feel at once that Professor Baldwin's mental constitution has no toleration for vague thinking, and that his style has a scientific sharpness about it that never admits of doubtful interpretation. The chapter throughout is characterized by a richness of ethical suggestion such as one rarely meets in text-books on psychology. Philosophers of Dr. Johnson's type, with their "we're free and there's an end on't," would learn not a little about the inner character of that freedom if they were willing to do the clear thinking which Baldwin's book makes possible.

Baldwin emphasizes with James[4] the absurdity of a conception of "motives" only too common among philosophical philistines. The conflict of motives is not a conflict between separate ideas with a distinct activity of their own, each exploding its own gun to compel submission from the others. Such a conception is worse than imaginary. "A motive is nothing in itself. It is only a name for a partial expression of the nature of the agent. Consequently motives can in no sense be considered as forces which expend their energies upon the will or which fight each other" (p. 353). Again, "how can they be conceived as separate entities contending in a theatre which is cold stone to all of them? Rather they are all vital elements in the functional synthesis of a living consciousness."

Another essential point is emphasized, namely, that when we penetrate to the inner nature of volition we find that it carries with it the act of attention (p. 351). This reminds one strongly of James's assertion that the real question of fact in the controversy on free-will relates to the "amount of effort of attention or consent" which could be given at any one time.[5] The role played by attention in deliberation and choice is of fundamental importance. Deliberation is a process of examination and comparison,— it is the searchlight of the mind illuminating the field of consciousness, bringing clearly into view alternative or incompatible desires,[6] and comparing their relative degrees of desirability prior to the act of choice which is the termination of the process: with choice the final fiat has gone forth, deliberation is at an end, and the deed is potentially done. "A resolve involves all the elements of a motor fiat except the word 'now.'"[7] Of the two great classes of motives, "affects" and "ends" involved in deliberation and choice, superior volitional worth is given to "ends." These are the more objective data before the eye of deliberation. "It is only by strengthening the influence of particular ends that effects enter." In fact, "what actual volition is concerned with is therefore ends, and ends only." If this be so, it is important to learn how an end passes into volition.

Baldwin's answer to this question is like Hodgson's.[8] The picturing of ends is a thinking process: it is an ordinary apperceptive act by which new elements are taken up into the old by a larger integration, the process being one of ab-

[1] cf. James's "Psychology," Vol. II., p. 522.

[2] "Psychology," Vol. II., p. 573.

[3] cf. James's "Psychology," Vol. II., p. 561.

[4] "Psychology," Vol. II., p. 569.

[5] "Psychology," Vol. II., p. 571.

[6] Mind, April, 1891, p. 170; "Free-Will: An Analysis," by Shadworth Hodgson.

[7] James, Vol. II., p. 561.

[8] April number of Mind, 1891, p. 171.

sorption and adjustment. "The attention moves throughout the series of elements, grasping, relating, retaining, selecting, and when the integration it effects swells and fills consciousness—that is the fiat" (p. 355). That is to say, the decisive point is reached, the rending strife is over, when the distracting character of the elements has been subdued, the unsettled claims satisfied, and the "attention gets its hold upon its integrated content as a grand related situation."

It is necessary to pin the attentive act down still closer. What can attention do in the matter of initiation of motives? Is attention unmotived? Is it independent of the internal and external conditions of endowment and environment? Professor Baldwin replies in the negative: an analysis of the two general classes of "apparent initiation of motive intensity"—cases of involuntary attention and cases of deliberation—renders an affirmative answer untenable. Strengthened intensity in the former cases is easily shown to be involuntary; in the latter, "as soon as any such preference comes in—any physical, mental, or emotional motive for wishing to intensify this particular alternative—then my choice is already made and I am fooling myself in thinking that I am reaching an unbiased decision."

Consequent upon these preliminaries comes the author's formal statement of the problem of freedom, in which he unfolds with great clearness of thought and transparency of expression the following four alternatives: (1) indeterminism, (2) external determinism, (3) immanent determinism, (4) freedom as self-expression. The contingent or indeterministic view, with its theory of unconditioned choice, meets with a very summary but warranted rejection. It is not only crudely unpsychological, but defeats the very end in whose interest it is projected; moral responsibility has the very ground cut from under its feet on any such theory; the conception of an agent whose voluntary expression involves moral judgment because he is agent, is emptied of all meaning. Professor Baldwin gives us here nothing new—nor was it necessary. This controversy has already been "thrashed out to the very last fragments of chaff."[1]

The external determinists are all those who explain volition in terms of natural causality, and thus consider the problem of volition a problem in physical dynamics. "Motives are forces in reference to one another, effects in reference to the brain, in which they have their causal support; volition is the consciousness of the outcome of a conflict of forces" (p. 370). The objection to this theory is that it floats in the air. To give it weight, an assumption is necessary, which neither science nor philosophy can substantiate. The theory assumes the possibility of a continuous movement under natural causality across the physical into the mental world. Whatever may be believed as to a "uniform psychophysical connection," there is no warrant for assuming that consciousness is an epi-phenomenon. So, too, there is no legitimate ground for believing motives to be mere natural phenomena. Baldwin is as positive as Green, though from a very different standpoint, that a motive is vastly more than a natural phenomenon. As to moral action, therefore, that view of it is false which supposes "that the motives which determine it, having natural antecedents, are themselves but links in the chain of natural phenomena."[2]

The analysis of motive exhibits three important results: 1. Choice is never motiveness. 2. The end chosen is always a synthesis of all present motives, and is adequately expressed by no one of them. 3. This synthesis is an activity *sui generis*: it finds no analogy in the composition of physical forces. With these results clearly in view, he finds that "freedom, therefore, is a fact, if by it we mean the expression of one's self as conditioned by past choices and present environment." "Free choice is a synthesis, the outcome of which is, in every case, conditioned upon its elements, but in no case caused by them"[3] (p. 373).

To read Baldwin's chapters on the will (for these were well worth the space of a separate review) is to feel that a mind of admirable scientific temper has been at work throughout. Approaching the phenomena of mind from the naturalist's point of view, he has guarded against the tendency, all too common in these days, of trying to drive the principle of physical causality through a multitude of facts, naturally and philosophically recalcitrant to such treatment. The great lesson of his two volumes is, that in psychology the application of scientific methods and canons to mental phenomena affords no results which a cautious metaphysic may interpret as casting discredit on spiritualism in philosophy.

ROGER B. JOHNSON.
Miami University, Oxford, Ohio.

[1] Jonathan Edwards, Day, etc.

[2] Green's "Prolegomena to Ethics," p. 93.

[3] cf. James, Vol. II., pp. 571-2.

SIR GEORGE BIDDELL AIRY.

THE cable has just flashed across the ocean the announcement of the death of Sir George Biddell Airy, the eminent astronomer of England. He was born on the 27th day of June, 1801, at Alnwick, in Northumberland, and had, therefore, just passed the half-mile post that would bring him to his ninety-first birthday.

Sir George Airy's life and work will always be looked upon as one of the most prominent pillars in the astronomical edifice erected in the nineteenth century. He had almost lived to see what had been done in that hundred of years. He had stood upon the pile of débris thrown up from the foundation, and looked down upon the formation of a structure, little dreaming that he would live to see the finishing touches put upon an edifice to which he had added so much material.

Airy was educated first at two private academies, Hereford and Colchester. From the latter, at the age of eighteen, he entered Trinity College, Cambridge. Three years afterwards he was elected to a scholarship. In that college he developed his remarkable mathematical ability, graduating as Senior Wrangler. His degree of M.A. was taken in 1826, and, with it, he was elected as Luscasian professor at Cambridge. Illustrious philosophers like Barrow and Newton had preceded him as occupants of that historic chair. Just previous to his election to that chair he published his mathematical tracts on the "Lunar and Planetary Theories," "The Figure of the Earth," etc., and "The Undulatory Theory of Optics."

Professor Airy, having been installed in the position just mentioned, followed his appointment with a series of popular lectures upon experimental philosophy, which were delivered with remarkable effect, and which greatly enhanced his scientific reputation. The university, recognizing in him one whose investigations were of a high order, elected him two years afterward to the Plumian professorship. This election gave him charge of the Cambridge astronomical observatory, and now is inaugurated an epoch in his life that is to elevate him to one of the highest positions held by English scientific men

Having been placed in the position above cited, Professor

Airy began those great improvements in the methods of calculating and publishing the astronomical observations made, which have led other observatories to take copy after him. Airy was a methodical man, a professional and a business man. He made his work conform to a scheme laid out the year before, and that plan was strictly followed. His work as an astronomer and a calculator is valuable, because it is unbroken and comparable. The astronomical instruments that have so long stood within the walls of Cambridge Observatory were made after his own plans and under his own directions.

In 1835 Professor Airy, then in his thirty-fourth year, was appointed Astronomer Royal. For forty six years he filled that position with marked ability. Under his master-mind it is needless to say that the astronomical observatory at Greenwich was completely changed. He placed the manner of reducing the observations upon a more satisfactory basis, and equipped the observatory with instruments of a higher order of precision. In the year 1850, under his guidance, a new meridian circle was erected. It has an object glass of eight inches aperture and eleven feet six inches focal length. In 1855, at his earnest solicitation, a large equatorial telescope was placed in the observatory.

Professor Airy was a man that not only combined the philosopher with the mathematician, but was one that had an inventive mind as well. This may be seen in the many forms of astronomical instruments and their accessories due to his very active brain. The value of the observations made by him during his occupancy of the position of Astronomer Royal at Greenwich, rests not only upon their accuracy and dispatch in being published, but on their continuity. This may be seen in his reduction of lunar observations from 1750 down to a late date, a most valuable series of observations.

Airy was a man in whom his government had the utmost confidence when it came to deciding questions of grave import. He was the chairman of the royal commission empowered to supervise the delicate process of contriving new standards of length and weight, the old standards having been destroyed in the burning of the House of Parliament in 1834. He was called in consultation soon afterwards in respect to removing the disturbance of the magnetic compass in iron-built ships. He thereupon contrived a mechanical combination which has been universally adopted. His researches on the density of the earth, his fixing the breadth of railways, his care in the equipment of the British expedition to observe the transit of Venus, and the reduction of the observations after having been made, — all voice the great confidence placed in him by his countrymen, and his worth as a practical astronomer.

The writings of Sir George Airy cover a great deal in the field of philosophical and mathematical thought, and are thorough in their discussion of each subject. His pen was ever busy, and one has but to turn to the volumes of the Cambridge Transactions, the Memoirs of the Royal Astronomical Society, to the *Philosophical Magazine*, and the *Athenæum*, to find its fruits. But in the volumes issued from the Greenwich Observatory we find the great life-work of Sir George Airy. They are the polished stones, the finely carved pillars that have been used in building up the astronomy of the nineteenth century. His principal works, which have become books of reference, are: "Gravitation," "Ipswich Lectures on Astronomy," "Errors in Observations," "Figure of the Earth," "Tides and Waves," "Sound," and "Magnetism."

One whose reputation as a man of such scientific attainment as Sir George Airy has deservedly received recognition, both from his own country and abroad. He has received the Lelande gold medal of the French Institute in honor of his important discoveries in astronomy. For his successful optical theories he was awarded the Copley gold medal of the Royal Society. The royal gold medal of the same society has been given him in return for his tidal investigations. Twice the gold medal of the Royal Astronomical Society has been given him — first, in return for his discovery of an inequality of long period in the movements of Venus and the earth; second, to reward him for his reduction of the planetary observations. He has been enrolled among the most honored members of the Royal Astronomical Society, of the Cambridge Philosophical Society, and of the Institute of Civil Engineers. For many years he has been among the foreign correspondents of the Institute of France, and other scientific sccieties on the continent. He has secured the honorary degree of D.C.L. and LL D. from each of the great universities of Great Britain — Edinburgh, Oxford, and Cambridge. In May, 1872, he was gazetted a Knight of the Bath.

When the years shall have passed into centuries, and coming astronomers are searching the records for valuable data to be used in the discussion of questions in astronomy, the observations and results determined by Sir George Biddell Airy will be found of the highest value.

GEO. A. HILL.

STRUCTURE OF THE TRACHEÆ OF INSECTS.[1]

MR. LACHLAN'S article on insects in the "Encyclopædia Britannica" reproduces Blanchard's error of a double chitinous wall for the tracheæ with a spiral thread between. Blanchard and Louis Agassiz superadded a peritracheal circulation of blood. Joly's refutation of this view, in 1850, failed to give the real cause of the error: this was not, as suggested by him, due to bad injecting; but it resulted from observing insects when moulting. At time of moulting the trachea contains the old chitinous wall, dark and enclosing air, and surrounded with exuding fluid between it and the new chitinous wall; thus the appearance of things is much as described by Blanchard, who mistook the exuded fluid for circulating blood, and also mistook a temporary state of matters for the normal state.

The view published by me in the *American Naturalist*, in 1884, that the spiral thickenings of the trachea are really crenulations, channel-like transverse folds open outwards (i.e., away from the lumen of the trachea) by a slit or fissure, was supported by indirect evidence, and needs to be enforced so as to leave no doubt. Miall and Denny, in their monograph on the cockroach, write as if they had been able to unroll the spiral like that of a vegetable trachea, without tearing the connecting membrane, and copy Chun's very inaccurate figure, which ascribes a free continuous spiral thread to the trachea of insects just as we find it in the plants.

A re-examination of the case brings out the singular result that the whole machinery can be distinctly seen by the microscope to be such as I have described it. The profile of a medium-sized trachea of any insect can be easily seen to be grooved like the edge of a screw: all the more clearly if the trachea is slightly stretched under the cover-glass. In the living insect we may observe that the resiliency of the transversely chanelled walls responds to the muscular contraction

[1] Abstract of a paper read by G. Macloskie before the American Association of Naturalists, Dec., 1891.

of the thorax and abdomen, so as to assist the tidal movement of air outwards and inwards.

I may add that one of Chun's figures (copied in the paper in *Am. Nat.*) correctly represents the spirals of *Eristalis*, giving even the external slits, highly magnified; but he misinterprets the slits, and takes them to be longitudinal ridges on what he supposes are solid threads. I have also pleasure in learning that my young friend, Professor H. T. Fernald of Pennsylvania Agricultural College, after reading my paper in 1884, stained and cut fine sections of *Passulus cornutus* and thus shows the spirals to be a set of hollow grooves enclosing some of the stained hypodermis which secretes and surrounds the tracheæ.

Princeton College, Jan. 21.

LETTERS TO THE EDITOR.

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

On request in advance, one hundred copies of the number containing his communication will be furnished free to any correspondent.

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

A Lightning Stroke.

ON the 30th of May, 1881, a party of ladies and gentlemen went in an omnibus from Washington to the country seat of a friend (H. C. Metzerott's), distant nine miles, in Prince George's County, Md.

During the afternoon the party was seated on the spacious veranda of the dwelling, the horses and omnibus standing on the lawn immediately to the front.

Suddenly a few clouds gathered, and, before any rain fell, a severe and sudden clap of thunder startled them. At the same instant a flash or streak of lightning descended and ripped apart the south-west corner of the roof of the frame carriage house standing alone about two hundred feet distant, descended down the sheathing to midway of the west, or end, wall of the carriage house, then at right angles apparently to the centre of the wall where the clap-boarding was ripped and shattered; then struck a brass-tipped pair of shafts standing near the north-west angle, shattering the right-hand shaft about midway, where a strip of iron covered with leather was placed to serve as a stay for the breeching strap; then apparently passed down and out at the floor by the closed door of the carriage house, where it was plainly seen by all the company moving along rapidly in small coils or circles up the road leading to the veranda, to the hoofs of the horses, playing around them with great velocity, and then apparently dissipated, no one could tell where. The horses were greatly agitated, fairly trembled, but did not move; and most of the company on the porch experienced a tingling, stinging sensation, but none were stunned. The sky soon cleared. J. H.

Washington, D.C., Jan. 25.

Traumatic Hypnotism.

THE case recently stated of a lady thrown into a hypnotic condition by being thrown from a carriage, in which condition she said and did certain things of which the next day she was entirely unconscious, brings to mind a fact that occurred near this place. Two lads of fourteen and sixteen went out to feed the stock. Coming near a young, almost unbroken colt, they leaped on his back. The animal started in a wild run for the barn, and dashing in at a low door struck the two lads violently against the beam that formed the top of the door. The door being very low the blow was not on the heads but the chests of the boys, sweeping them from the colt's back to the frozen ground. The elder lad sat behind his brother, and was thrown heavily to the ground, striking the back of his head, his brother falling upon him. Both lads rose; the elder rubbed his head, looked about, went into the barn and completed his evening tasks in an orderly manner, replying to his brother when addressed. They went to the house, and the lad warmed himself by the stove, went to the table, ate a lighter supper than usual, and replied intelligently when spoken to; but his eyes were dull and had a dazed, half-conscious look. After supper he sat by the fire for some time, laughing aloud once or twice "at nothing"—than went to bed as usual. The next morning it was found that he knew nothing of any event after the instant of jumping on the colt's back, and seeing it dash off toward the barn. He had not felt the blow, nor been conscious of the fall, or of any subsequent words or acts, until he arose the next morning, but his conduct and appearance had been normal, except the causeless laughter and the dull look of the eyes. In the case of the lady flung from her carriage, she went into a druggist's, asked for water and a clothes-brush to renovate her dress, said she was not injured, needed no help, etc. Thus she said and did things suitable to the conditions of her accident. The lad, on the other hand, continued the course of action which he had begun before his fall, feeding the stock, etc. His acts during the evening were acts of habit, and such as he repeated every evening. Neither the lady nor the lad were dominated by any other mind, nor directed in their motions by any person conscious of, or responsible for, their state, but it seems that by reason of a blow given on the back of the head in each case, both the lady and the lad were in a true hypnotic state, and were subsequently entirely oblivious of all that had occurred while they were in that condition. JULIA MACNAIR WRIGHT.

Rain-Making by Faith.

SOME of the readers of *Science* doubtless may recall numerous memorable incidents of the administration of the genial, earnest, shrewd, and eccentric President Phinney of Oberlin. Apropos to recent articles on faith-healing and rain-making is a vivid recollection of such an incident.

Some forty years ago, on a cloudless Sabbath morning, the president walked briskly up the chapel, — there had been a distressing drouth, — and began the service with an extremely fervent prayer for rain. The prayer was long, and before it was finished the skies began to darken, and almost before the congregation was dismissed a copious rain began to fall. The suggestive fact in this relation is that President Phinney had been observed during the morning to give very watchful attention to the barometer. H. CHANDLER.

Buffalo, Jan. 25

Some Curious Catnip Leaves.

As I passed by an old deserted log cabin, where the soil was poor and barren, I noticed a bunch of catnip in an angle of the pioneer zigzag fence. So close in the corner was it, that it seemed as if it had crept there for protection. But even in its apparent retreat it was conspicuous, for vegetation generally had succumbed to the frosts of early autumn. A society for the prevention of cruelty to plants ought to be organized, I thought, for here was this little stunted-looking bunch of catnip, struggling for existence, when it certainly seemed physically unable to cope with the unfavorable conditions for growth surrounding it. Poor little lonely weed, I mused, is it just that you should struggle here alone against all the hardships which put even the best dowered plants to the test? and like my humane brothers who, in order to end the misery of a poor misused horse, feel compelled to take its life, I terminated its struggles by collecting it.

The catnip (*Nepeta cataria*) has a beautiful leaf, with a rather deeply crenate margin; its upper surface has a rich, soft, downy, rather velvet-like appearance, while the deep green color is a witness of its hardihood. But the leaves on this plant, which out of compassion I magnanimously collected, were very different from the normal type; the surface was nearly smooth, and the margin of many leaves was quite entire; others were crenate only near the base of the leaf, though entire toward the apex, as shown in the accompanying illustration. Why, and wherefore, this difference in the leaves? I queried. Why have they varied from the shape recognized as the typical leaf? The little leaves themselves replied: "We are the result of poor, unfavorable conditions; we had neither strength nor vitality sufficient to elaborate the modern catnip leaf, though we recognize its superiority over our own shape and appreciate the fact that the most advanced, progressive leaves are those most deeply notched. We are reversions to a more ancient, primitive type of leaf, like those borne by our ancestors. When our environment is such that we are starved, even at the threshhold of life, we cannot adorn ourselves with the modern improvements, now so commonly worn." "You will notice," the leaves continued, "that we grew on branches of the summer's seed-stalk. The upper part of it was already dead, but the lower portion had still sufficient vitality to send out these feeble branches; they were only able to follow in the old, old rut, worn by preceding generations, and therefore we are simply what you might with propriety denominate very old-fashioned catnip leaves."

I was much impressed by this explanation, but, even though the leaves themselves had answered my query, like Thomas of old, I still doubted.

NEPETA CATARIA.

Scores and scores of plants were questioned in regard to the cause of this variation from the normal type, and in every case the same story was told. The leaves borne by the branches of the old seed-stalk were often wholly entire, or crenate only towards the base.

All the leaves which grow on the radical shoots are perfected in their crenate outline to the apex; and, while the leaves of the radical shoots are green, even at this season (January), these "old-fashion-leaved" branches have long been frozen and dead.

All things unfold according to their environment, directed by heredity. In geologic times the ancestral hereditary force pushed on the conditions; plants and animals responded by adaptation; or, where they could not adapt themselves to their ever changing environment, they were left behind, and became extinct. The law of evolution says: "Advance with me, or fall from the ranks!" Plants and animals, races, nations and tribes, are yet falling out of rank because they cannot comply with the requirements necessary to endure or cope with the constantly changing conditions.

It took the catnip we know not how long to overstep the entire leaf; but, after studying the variation of leaves, who can doubt that the present crenate leaf is the result of evolution.

MRS. W. A. KELLERMAN.

Columbus, O., Jan. 18.

AMONG THE PUBLISHERS.

Outing readers will welcome back to its pages the now renowned world traveller and explorer, Thomas H. Stevens, who with his cycle girdled the world for *Outing*, and who has just achieved a successful expedition from the German Ocean to the Black Sea in a steam launch, despite the dangerous rapids of the Iron Gates. *Outing* for February opens with a charming description of "Cycling in Mid-Pacific," by Charles E. Trevathan, in which the author draws a pleasant picture of the natives, foliage, flowers, and the delights of wheeling over the snow-white coral roads of dreamy Tahiti.

— D. Appleton & Co. announce a new book by Arabella B. Buckley, author of "The Fairyland of Science," "Life and Her Children," etc. The title of this work will be "Moral Teachings of Science," which the author is said to have invested with special interest.

— Macmillan & Co. announce for publication early in February a practical work on electric lighting. The full title of the book is "A Guide to Electric Lighting for Householders and Amateurs," and the author is S. R. Bottone, well known by his previous books on electrical subjects. In order to make the book thoroughly serviceable to readers in this country the proofs have been read by an American scientist, for the purpose of supplying any needed explanation of merely local usage.

— Longmans, Green, & Co. have in press a work by the late Ferdinand Praeger, entitled "Wagner as I Knew Him." The book, which is the outcome of Dr. Praeger's life-long intimacy with Wagner, is a remarkably clear, sympathetic, and unprejudiced history of the man and the composer, especially valuable for its frank discussion of episodes in his life usually treated with hesitation by his biographers. Dr. Praeger had the privilege of reading Wagner's autobiography in manuscript, and thus verifying his own observations by Wagner's own statements.

— The latest publication of Professor Eben N. Horsford concerning the ancient settlements of the Norsemen in the territories of the New England States was published in large quarto size by Damrell & Upham, Boston, and bears the title, "The Landfall of Leif Erikson, A.D. 1000, and the Site of his Houses in Vineland, 1892." Leif's houses are placed on the Charles River, below the Fort Norumbega, and a short distance above Boston, Mass. The book is very profusely illustrated with photographic views and with the maps which have come down to us from the earliest explorers of the sixteenth century, and so on to the end of the nineteenth. This collection alone makes of the volume a thesaurus of cartographic informatian surpassed by no other recent publication. The amount of historic and topographic information gathered from all the earlier historians and other authorities on New England matters is enormous, and they are classed under appropriate headings, of which the principal are as follows: The Landfall, Expedition of Bjarni, Thorwald's Expedition to Vineland, and Sketch of the Thorfinn Expedition to Vineland. Then come a résumé, an appendix, and notes. This volume of 147 large quarto pages is printed with wide margins, holds 39 maps and illustrations, the typographic execution being of the most splendid. Simultaneously with the above was issued a pamphlet in a smaller quarto size, also provided with maps of the New England coast, entitled, "Sketch of the Norse Discovery of America at the Festival of the Scandinavian Societies, assembled May 18, 1891, in Boston, on the Occasion of presenting a Testimonial to Eben Norton Horsford in Recognition of the finding of the Landfall of Leif Erikson, the Site of his Vineland Home and of the Ancient Norse City of Norumbega, in Massachusetts, in the Forty-third Degree."

— The literature of South American ethnology has just been enriched by a fine pictorial publication in folio, being Nos. 1 and 2 of the second volume of the "Veröffentlichungen," issued from time to time by the direction of the Royal Museum of Ethnography at Berlin (80 p. and 16 plates, Berlin, W. Spemann, 1891). The explorer, Dr. P. Ehrenreich, here presents his observations, studies, and experiences from July to November, 1888, among the tribes of the Araguaya River in the Brazilian province of Goyaz and those of the Puru River, a tributary of the middle Amazonas. These reports appear under the modest subtitle, "Beiträge zur Volkerkunde Brasiliens," and the illustrations in the text are just as instructive as those in the plates. Of the Goyaz tribes the Karaya were the chief object of the explorer's studies; among the Puru tribes, the Yamamadi, Ipurina, and Paumari. The accounts given of their customs and manners, implements, weapons, dances, and other merrymakings are as interesting as the specimens of their folk-lore, of which many instances are inserted. The masks used in the dances cover the whole body, and are figured on pages 35 and 36.

— Warren K. Moorehead writes, in the *Illustrated American* for Jan. 30, a most remarkable and interesting story about "New Relics of the Mound Builders in Ross County, Ohio." One of these relics, he says, is the skeleton of a man with copper helmet with antlers, and the other is a Swastika cross, oriental in character, and is one of the first finds ever unearthed to show the origin of the Indians. He says in this connection: "The discovery of four crosses, which are peculiarly oriental in character, marks a new epoch in American archæology. M. G. de Mortiellet, the eminent French anthropologist, refers to the same style of cross found by the survey, and gives numerous illustrations in his works of its occurrence on pottery, sepulchres, and monuments of Brittany, Italy, and particularly India. The Swastika was used as one of the emblems of Buddha worship before the Christian era, and may have spread later into Phœnicia. This symbol is occasionally found in Egypt and China, but, so far as the writer is aware, not in Yucatan or Mexico. A cross does occur on the Palestine tablet, but it is not the Swastika. No skeleton in the mound indicated a person of more importance than No. 248. Copper antlers, 22 x 23 inches, extended from the forehead upward. The breast and back were covered with copper plates, bear teeth, and other singular ornaments. Strings of beads lay about the ankles and wrists, while at the feet were traces of decayed sandals. The copper horns had been originally fastened to a helmet of copper, covering the skull from the upper jaw to the base of the occipital. A rough cloth skirt extended from the waist to the knees. Where the copper plates came in contact with the fabric it was well preserved. Beautiful pearl beads and large bear and panther tusks were interlaced or strung upon the front of the garment. The other skeletons were covered with shell beads, and a few copper plates and celts accompanied them."

— It is the design of the Modern Science Series, published by D. Appleton & Co., to provide brief untechnical treatises for the educated layman who has neither time nor inclination to become a specialist, but who feels the need of informing himself on the

Wants.

Any person seeking a position for which he is qualified by his scientific attainments, or any person seeking some one to fill a position of this character, be it that of a teacher of science, chemist, draughtsman, or what not, may have the 'Want' inserted under this head FREE OF COST, *if he satisfies the publisher of the suitable character of his application. Any person seeking information on any scientific question, the address of any scientific man, or who can in any way use this column for a purpose consonant with the nature of the paper, is cordially invited to do so.*

WANTED.—(1) A white man versed in wood and iron working, able to work from specifications and plans, suited for an instructor of boys; his business to have charge of shops of school, outline and direct the work for foremen and students; salary to be $1,000 per annum (nine months). (2) A man (black preferred) to teach the colored, iron working and forging, subordinate to the preceding; salary, $720. (3) A man (white) competent to take classes in engineering (assistant's position), but with the ability to perform any of the work required in any of the ordinary engineering courses of our universities; salary from $1,000 to $1,500. A. H. BEALS, Milledgeville, Ga.

WANTED.—Two or three efficient computers with good knowledge of Spherical Trigonometry and ready use of logarithms, for temporary employment in the office of the Coast and Geodetic Survey. Applicants should furnish evidence of their fitness for the work. Apply by letter to the Superintendent, Coast and Geodetic Survey, Washington, D.C.

WANTED.—*Science*, No. 178, July 2, 1886, also Index and Title-page to Vol. VII. Address N. D. C. Hodges, 874 Broadway, New York.

A YOUNG MAN (31) would like a position in a college, laboratory, or observatory, is also willing to assist at a steam engine, etc. Address J. W., care of *Science*, 874 Broadway, New York.

WANTED.—A position in the philosophical or pedagogical department of a college or university by a young man (30) who has had five years' practical experience in teaching, and who has done four years' post-graduate work in philosophy, devoting his attention during the last two years especially to study and original investigation in scientific psychology and its applications in education. Address E. A., care *Science*, 874 Broadway, N. Y. City.

WANTED.—A suitable position in Washington, D. C., not connected with the Government, and with a salary not to exceed $650 a year, by an experienced biologist with six years' university training. Applicant has been a skilful surgeon for fourteen years; is a practical photographer, cartographer, and accustomed to the use of the type-writer. He is also capable of making the most finished drawings, of any description, for all manner of illustrative purposes in science; trained in museum methods and work; also field operations and taxidermy in its various departments, and modeling, production of casts, restorations of paleontological specimens and similar employments. Address U. S. R., care *Science*, 47 Lafayette Place, N. Y.

Exchanges.

[Free of charge to all, if of satisfactory character. Address N. D. C. Hodges, 874 Broadway, New York.]

Wanted, in exchange for the following works, any standard works on Surgery and on Diseases of Children: Wilson's "American Ornithology," 3 vols.; Coues' "Birds of the Northwest" and "Birds of the Colorado Valley," 2 vols.; Minot's "Land and Game Birds of New England;" Samuels' "Our Northern and Eastern Birds;" all the Reports on the Birds of the Pacific R. R. Survey, bound in 2 vols., morocco; and a complete set of the Reports of the Arkansas Geological Survey. Please give editions and dates in corresponding. R. ELLSWORTH CALL, High School, Des Moines, Iowa.

Wanted to buy or exchange a copy of Holbrook's North American Herpetology, by John Edwards. 5 vols. Philadelphia, 1842. G. BAUR, Clark University, Worcester, Mass.

For sale or exchange, LeConte, "Geology;" Quain, "Anatomy," 2 vols; Foster, "Physiology," Eng. edition; Shepard, Appleton, Elliott, and Stern, "Chemistry;" Jordan, "Manual of Vertebrates;" "International Scientists' Directory;" Vol. I. *Journal of Morphology;* Balfour, "Embryology," 2 vols.; Leidy, "Rhizopods;" *Science*, 18 vols., unbound. C. T. McCLINTOCK, Lexington, Ky.

For sale.—A 6½ x 8½ Camera; a very fine instrument; with lens, holders and tripod, all new; it cost over $40, price, $25. Edw. L. Hayes, 6 Athens street, Cambridge, Mass.

To exchange Wright's "Ice Age in North America" and Le Conte's "Elements of Geology" (Copyright 1882) for "Darwinism," by A. R. Wallace, "Origin of Species," by Darwin, "Descent of Man," by Darwin, "Man's Place in Nature," Huxley, "Mental Evolution in Animals," by Romanes, "Pre-Adamites," by Winchell. No books wanted except latest editions, and books in good condition. C. S. Brown, Jr., Vanderbilt University, Nashville, Tenn.

For Sale or Exchange for books a complete private chemical laboratory outfit. Includes large Becker balance (200g. to 1-10mg.), platinum dishes and crucibles, agate motors, glass-blowing apparatus, etc. For sale in part or whole. Also complete file of *Silliman's Journal*, 1862-1885 (62-71 bound); Smithsonian Reports, 1854-1883; U. S. Coast Survey, 1854-1869. Full particulars to enquirers. F. GARDINER, JR., Pomfret, Conn.

For exchange or sale at a sacrifice, an elaborate microscope outfit. Bullock stand; monocular objectives, one-sixth homogeneous immersion, four-tenths, and three inch, Bausch & Lomb, also one-fourth and one inch Spencer. Four eye-pieces. Objectives are the best made. Address Mrs. Marion Smith, 41 Branch Street, Lowell, Mass.

present status of the various branches of science. The second volume is entitled "The Horse: A Study in Natural History," and is intended to especially illustrate some important principles in biology. It outlines the principal characteristics of the comparative anatomy of the horse and his near relations, the tapir and the rhinoceros, and shows incidentally how a "missing link," described by Professor Huxley in 1877, has since been found in the Lower Eocene deposits, thus identifying a connection believed to have existed in the ancient ancestry of the animals. The author is William H. Flower, C.B., director of the British Natural History Museum.

— "Evolution in Science, Philosophy, and Art" is the title of a book containing seventeen lectures by Professor John Fiske, Mr. Underwood, Dr. Abbott, Mr. Wakeman, and other able exponents of evolution, which is to be published immediately by D. Appleton & Co. The principle of evolution being universal, admits of a great diversity of applications and illustrations, and many which appear in this volume are fresh and striking. The scientific lectures, as in the case of that by Dr. Alleman on Optics, are often of direct practical value. These lectures when delivered before the Brooklyn Ethical Association attracted general attention. In book form they are accompanied by a letter from Herbert Spencer, and by numerous illustrations.

— The title of Tyndall's forthcoming book is "New Fragments." Among the subjects which are treated in the five hundred pages are The Sabbath, Life in the Alps, The Rainbow and its Congeners, Common Water, and Atoms, Molecules, and Ether-Waves. In addition to the popular treatment of scientific themes, the author devotes several chapters to biographical studies of the utmost interest. Among the subjects of these studies are Count Rumford and Thomas Young, and there are also chapters on Louis Pasteur, his Life and Labors, and Personal Recollections of Thomas Carlyle. Tyndall's "New Fragments" will be published immediately by D. Appleton & Co.

SCIENCE

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CONTENTS.

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QUERY.

Can any reader of *Science* cite a case of lightning stroke in which the dissipation of a small conductor (one-sixteenth of an inch in diameter, say,) has failed to protect between two horizontal planes passing through its upper and lower ends respectively? Plenty of cases have been found which show that when the conductor is dissipated the building is not injured to the extent explained (for many of these see volumes of Philosophical Transactions at the time when light ning was attracting the attention of the Royal Society), but not an exception is yet known, although this query has been published far and wide among electricians.

First inserted June 19. No response to date.

N. D. C. HODGES,
874 BROADWAY, NEW YORK.

SCIENCE

NEW YORK, FEBRUARY 5, 1892.

A LUMP OF SALT AND A GLASS OF WATER.[1]

WITH ordinary use the powers of eye, ear, smell and touch fail to distinguish between the glass of pure water, and that to which salt has been added. The taste alone gives immediate evidence of the difference. But let us examine more closely, and, first, by chemical tests. Solution of silver nitrate, added to the brine, gives a white, curdy precipitate containing chlorine, a platinum wire would take up enough to impart a yellow color to the Bunsen flame, indicating sodium. Thus two constituents may be separately recognized in the solution by the appropriate tests, where only common salt was added. So, in general, if we wish to detect a salt in solution, we depend upon properties belonging to the basic radical and those belonging to the acid radical; the appropriate tests being separately applied. Such properties are called "additive," since they express the sum of the properties of the constituents. The special use of this term may be clearer on reviewing some electrical properties.

Two kinds of solutions are distinguished by means of the electric current. Absolutely pure water seems to be a non-conductor, while the addition of a salt, acid, or base enables the current to flow, the added body being separated into two parts called ions, which appear at the two electrodes. Such bodies are called electrolytes; and the quantity of electricity passing through the fluid is directly proportional to the quantity of electrolyte decomposed. Many organic bodies are not thus decomposed, their solutions being non-conductors. While the molecule of common salt is believed to contain but two atoms, and sugar contains at least forty-five, yet the former may be separated by the electrical influence in a manner from which the latter is free. The forty-five atoms of the sugar molecule dwell together as a unit, while the two atoms of common salt may part company and enter into new relations, thus presenting a scene of activity and complexity which we should hardly expect from its apparent simplicity.

Let a current pass through a solution of copper sulphate, entering through a copper plate, and passing out at any properly coated form; the copper is carried through the solution with the current, and is deposited as an electro-plate coating; while the negative radical slips back to attack the kathode. The quantity of basic and acid radicals thus transferred, under given conditions, depends upon the conductivity of the solution; but to compare solutions of different kinds we should make the concentration proportional to the chemical equivalents. In this way Ostwald has measured the molecular electrical conductivity of many solutions of varying degrees of concentration. The following are a few of his results to the nearest unit for extremely dilute solutions — $\frac{1}{1024}$ normal. The differences are shown in small, bold-face type.

Li Cl,	110	**9**	Na Cl,	119	**23**	K Cl,	142
	5			**5**			**6**
Li NO_3,	105	**9**	Na NO_3,	114	**22**	K NO_3,	136
	8			**7**			**6**
Li ClO_3,	97	**10**	Na ClO_3,	107	**23**	K ClO_3,	130

[1] Abstract of the annual address before the Washington Chemical Society, delivered Jan. 28, 1892, by Robt. B. Warder.

The numbers obtained for lithium salts are about 9 less than for the corresponding sodium salts, and these about 23 less than for the potassium salts. Comparing the horizontal lines we find the numbers for chlorides about 5 higher than for nitrates, and these about 7 higher than for chlorates.

To appreciate the full meaning of these differences in the numbers we may again refer to the tests of qualitative analysis. A salt has no single property by which it is recognized, but we depend upon the several properties of basic and acid radicals, which are largely independent of each other. The molecular electrical conductivity is here expressed merely by a number; but do not be repelled by a sense of vagueness. This number expresses motion, — the greater the number the more activity displayed in transfer of electricity. The lithium atom is less active in this way than sodium; and this is true, whatever be the company in which the metal is found. The activity of chlorine is greater than that of the nitric radical, and this greater than the chlorine radical; but the activity of the salt must be viewed as the sum of this property for the components. Each number is clearly the sum of two numbers, one belonging to the basic, the other to the acid, radical. On no other hypothesis can we explain the fact that when we select two basic or two acid radicals the substitution of one radical for the other always results in the same change of the number, no matter what third radical may be combined with these two. In a word, the molecular electrical conductivity is an additive property of salt solutions.

If we leave water and brine in the cold both will freeze; but the brine must be cooled to a lower temperature before freezing begins. The differences between freezing point for solutions and the solvent have been made the subject of many extended researches with special forms of thermometer. Readings are estimated to .01°. The result has been a flood of light upon the molecular weights of substances in liquid form, together with some remarkable differences between salt and sugar, between brine and syrup, or between the two classes of solutions which these represent.

Take three similar barometers, introduce a drop of water into the Torricellian vacuum of the first, and the mercury falls; the water is partly changed to vapor, which exerts a certain pressure on the mercury, and this vapor pressure may be measured by the difference in level. Now put a drop of brine into the second barometer, the mercury falls here also, but to a less extent. The vapor pressure of the brine is less than that of pure water. The process of evaporation or condensation in a current of air affords another means of determining the relative vapor pressure of various solutions. If we now boil water and brine in separate vessels the pressure of vapor equals that of the atmosphere; but, when this point is reached, the brine is hotter than the water, — the boiling point of the former is higher. Thus we have a third method of comparing vapor pressures. This property of solutions, in its quantitative aspect, rivals the freezing point as an avenue to the secrets belonging to our subject, which are yet only partly disclosed. As solution proceeds the denser brine gradually mixes with the water above, until at last the whole fluid would be practically uniform. Various salts will diffuse at different rates. A porous membrane will transmit the molecules of water more readily than those of a salt. For certain theoretical investigations we may conceive a "half permeable" wall with openings so small that the water alone can penetrate. As a filter separates a solution from the insoluble residue, so the half-permeable wall is to transmit the solvent, while preventing the passage of the dissolved salt. No material has been found fully possessing this ideal property; but theoretical deductions have already been confirmed by experiments with clay cells, the pores being partly closed with a film of insoluble precipitate. If a solution fills such a cell, while fresh water surrounds it, the contents soon show a considerable pressure, which is measured by a manometer. This phenomenon is called "osmotic pressure," and we may have several conceptions of its cause. Either there is an attraction between the unlike molecules in the brine and the fresh water, so that the latter flock in where the salt is imprisoned (as ducks fly to the decoy) until the internal pressure arrests the flow; or the osmotic pressure may be due to the aggregate force of impact of the many moving molecules; this is the view generally taken.

The several properties that have just been considered require numerical expression, but these numbers are wonderfully related to each other and to the doctrine of the conservation of energy. For example, consider the relation of osmotic pressure to vapor pressure. Let a cell with half-permeable wall, connected with a vertical tube be filled with solution, and immersed in a tank of pure water; the whole arrangement being placed under a bell jar in vacuum. Under osmotic pressure the solvent will enter the cell until a certain pressure is reached, as determined by the height of the liquid in the vertical tube. Evaporation will take place at the same time, both from the surface of the solution in the tube and from the solvent in the tank, at their respective levels, until the jar is filled with vapor. A condition of equilibrium will eventually be reached, for otherwise we should have perpetual motion. On the half-permeable walls of the porous cell we have an inward and an outward pressure, whose difference is measured by the height and density of the solution in the vertical tube. On the surface of the two fluids we have a vapor pressure, the difference being measured by the same height and the density of the vapor in the bell jar. The former value is the osmotic pressure, the latter is the diminution of vapor tension caused by adding the solid to the solvent; and these two values stand exactly in the ratio of the densities of solution and vapor. By other thermo dynamical considerations a relation is traced between osmotic pressure and the change in freezing point, electrical conductivity, etc.

Important analogies between the physical properties of gasses and those of dissolved bodies are pointed out by van't Hoff; the laws of Boyle, Gay-Lussac, and Avogadro all have their counterparts in the phenomena of osmotic pressure.

First. Boyle's law says that the pressure of a gas is inversely proportional to its volume; that is, that as the quantity of any gas in a given volume is increased or diminished the pressure changes in the same ratio; so, the osmotic pressure of many solutions is found to vary directly as the concentration.

Second. Gay-Lussac's law may be expressed by stating that the gaseous pressure varies directly as the absolute temperature; the same is true of osmotic pressure.

Third. Avogadro's law implies that two gases, at the same temperature, will have equal pressures when the masses of equal volumes are proportional to the molecular weights. The same is true for osmotic pressures in equivalent solutions of different comparable substances. To calculate the osmotic pressure conceive the solvent to be absent, while the solid occupies the same space as gas; the hypothetical gaseous pressure, as determined by the three fundamental laws, is then equal to the osmotic pressure required. Conversely, to determine the molecular weight of a dissolved body, we may find the osmotic pressure and calculate as for a gas; practically, the depression of freezing point is the physical property usually measured.

In a word, the three fundamental laws of gaseous matter are found to be true of dissolved matter simply by substituting osmotic pressure for gaseous pressure, while even the anomalies and limitations so long recognized in gases and vapors find their counterparts in solutions. Can we find identity of cause when there is almost identity of result? In a gas matter is in a far more dilute condition than in ordinary solids or liquids; the intermolecular spaces are evidently far greater than the space occupied by the molecules themselves. The same is true in a dilute solution of salt, only here the intermolecular space is largely occupied by the water. In both cases, motion is indicated by the phenomena of diffusion. In both cases, each moving molecule is endowed with kinetic energy, and the sum of the vis viva of all the molecules exactly accounts for the laws of pressure. The formulas used to unfold the kinetic theory of gases may be applied without change to a kinetic theory of solutions. In a jar of hydrogen, the molecule darts hither and thither at the rate of a mile a second, asking for no support save other molecules, from which it rebounds. If hydrogen mixes with the denser vapors of paraffin, it will still exert its own pressure upon the walls of the vessel, as though it were alone. Our salt is less ethereal. The molecules are heavier. They move more sluggishly. Very slowly do they rise, as though climbing with painful effort upon an unsteady ladder of water molecules. Yet, with the aid of the half-permeable wall, their pressure is found to be just what it should be on the kinetic theory, if the salt alone occupied the space in absence of water.

Anomalies and limitations have always been mentioned. There is no "perfect" gas, none that exactly fulfils the fundamental laws, but hydrogen, which most nearly agrees with the "ideal gas" in its properties, is not compressed to one-tenth its volume by ten-fold pressure, but occupies a little more than one-tenth volume. Here, the molecules themselves may be considered as incompressible bodies occupying too great a fraction of the whole space to be left entirely out of account. A modification of Bowle's law assumes that the total intermolecular space varies inversely as the pressure. In most gases and vapors, however, the deviation is in the opposite direction. As the molecules approach each other their mutual attraction is manifested, for the volume becomes less than required by Boyle's law. The piston of a Corliss engine, which glides so beautifully to and fro, in obedience to valve and governor, is impelled by the bombardment from an army of vapor molecules, each one following its own impulse almost untrammelled in the go-as-you-please contest; yet some mutual attraction is manifest, for the steam exerts a little less pressure upon the piston than would an ideal gas under like conditions. So, osmotic pressure, instead of increasing directly as the concentration, may increase a little less rapidly. There is a well-known body whose vapor density has long been recognized as abnormal.

Ammonium chloride, when converted into vapor, is found to occupy twice the volume predicted by theory, — in other words a given volume of the vapor exerts twice the theoretical pressure. The explanation is easy when we learn that the salt is dissociated into the two gases, ammonia and hydro-chlorine acid. Similar anomalies in osmotic pressure may lead to a similar interpretation, although quite antagonistic to our ordinary conceptions and teachings. Sodium will burn in chlorine with striking evolutions of light and heat; we recognize the product as a new substance. Chemical action has taken place. By a large expenditure of energy the elements may again be separated; this also is chemical action. But we dissolve the salt in water, evaporate, recover it as before, and are prone to count all these changes as purely physical. Little do we suspect that the dilute solution contains in free state the two substances which we usually know as metal and gas, the two kinds of atoms moving independently of each other, so long as they are distributed in equal numbers in any portion of the fluid. Yet such is the theory of Arrhenius, now fast gaining ground. Cold water decomposes a most stable compound, the elements being gradually reunited in evaporation and crystallization. Accept this hypothesis for electrolytes and their peculiar properties are explained, their additive character must follow as a necessary consequence of their nature, and the several kinds of anomalies fall into harmonious relations.

On this hypothesis the speed of chemical change should no longer be proportioned to the whole quantity of each active substance present, but rather in proportion to that part which has already suffered loosening of the bonds. The facts of dynamical chemistry afford an independent and valuable confirmation of the new views.

THE ORIGIN OF THE ASS, THE CAT, AND THE SHEEP IN CHINA.[1]

AT a recent meeting of the China Branch of the Royal Asiatic Society in Shanghai, Dr. Macgowan, a well-known Chinese scholar, read a paper on the probable foreign origin of the ass, the cat, and the sheep in China. He said that the Chinese, in their numerical co-ordination of concrete and abstract nature, give the "six domestic animals" as the horse, ox, goat, pig, dog, and fowl; which seems to indicate that when that formula was framed, neither cat, sheep, nor ass had been domesticated there. When familiar beasts were selected to denote years of the duodenary cycle, to the "six domestic animals" were added the rat, tiger, hare, dragon, serpent, and monkey, to complete the dozen, as if the ass, sheep, and cat were too little known to meet the object in view, which was the employment of the most familiar representations of animated nature for the duodendary nomenclature. Still more striking is the absence of the ass, sheep, and cat from the twenty-eight zodiacal constellations, which are represented by the best-known animals.

With regard to the ass, there is ample reason to regard it as being excluded from the list of domestic animals because it was not archaic. The hybrid mule is of comparatively modern origin in China, dating back only about a score of centuries. A miscellany of the Sung era states that "the mule was not seen during the Hsai, Shang, and Chou dynasties; that it was a cross between the ass and horse from Mongolia. It is regularly bred in the north, and is worth in the market twice as much as the horse; it is popularly reported that its bones are marrowless, which is the reason of its inability to produce its kind." Again, it is recorded in a Ming cyclopædia: "The mule is stronger than the horse, and is not a natural product of China; in the Han era it was regarded as a remarkable domestic animal." Is it likely that, if the ass existed during the three ancient dynastics, there was no crossing with the horse?

With regard to the cat, Dr. Macgowan proceeded to state that there was a quotation from a standard work which discloses the fact that Yuang Chuang, the pilgrim monk, who, in the seventh century A.D., returned after sixteen years' wanderings in India, brought cats with him to protect his collection of Sanscrit Buddhist books from rats. That account, however, is somewhat invalidated by an anecdote of Confucius, who is related to have one day seen a cat chasing a rat. These conflicting statements are from authoritative sources, and it is impossible to offer a satisfactory explanation. Possibly the cat of Confusian times was only a partially domesticated wild cat. There must have been some ground for the statement of the cat having been brought from India, as it is hardly likely that in all the long period of Chinese history it should be named but twice as a domestic animal. He quotes from Chinese folk-lore on the subject of cats. As cruelty to cats and other animals is followed by retribution, so services rendered to them meet with supernal recognition. As anciently the tiger was sacrificed to because it destroyed wild boars, so the wild cat was worshipped because it was the natural foe of rats; boars and rats being the natural enemies of husbandry. At the commencement of the Sui dynasty, A.D. 581, the cat spirit inspired greater terror than the fox did subsequently. The hallucinations of cat spirit mania prevailed, forming a remarkable episode in Chinese history, only to be likened to the fanatical delusion of witchcraft that frenzied Europe a thousand years later. It was believed that the spirit of a cat possessed the power of conjuring away property from one person to another, and inflicted through incantations bodily harm. The popular belief was intensified and spread like an epidemic, until every disastrous affair that took place was ascribed to cat spirit agency set in motion by some mischievous enemy. Accusations were lodged against suspected persons, and, the slightest evidence sufficing for conviction, the malicious were encouraged to trump up charges against the innocent, until the country became a pandemonium. No one was safe, from the Imperial family down to the humble clodhopper. Even a magnate of the reigning house, who enjoyed the titular distinction of Prince or King of Szechuan, was executed for nefariously employing the agency of cat spirits. In this manner several thousands were immolated before the delusion was dispelled. Happily the period appears to have been of brief duration: incentives such as kept up the witch mania for centuries were wanting in China. Coming down to our own times we find a cat-craft delusion prevailed over a great portion of Chêkiang. "In the summer and autumn of 1847 frightful wraiths appeared throughout the departments of Hangchow, Shaohsing, Ningpo, and Taichow. They were demons and three-legged cats. On the approach of night a fœtid odor was perceptible in the air, when dwellings were entered by something by which people were bewitched, causing alarm everywhere. On detecting the effluvium in the air, householders commenced gong-beating, and the sprites, frightened by the sonorous noise, quickly retreated. This lasted for several months, when the weird phenomena ceased." Well did he remember, said Dr. Macgowan, the commotion that prevailed in Ningpo throughout those months of terror. Every gong that could be procured or manufactured for the occasion was subject to vigorous thumping

[1] From Nature.

through the livelong night, maintained with vociferations by relays of zealous beaters. This deafening din was but a recrudescence of what had occurred a few generations before — a panic which was only exceeded by that which subsequently prevailed over the entire empire.

With regard to sheep, Dr. Macgowan said the ancient mode of writing the character for *yang*, goat, was ideographic — four strokes on the top to represent horns, two horizontal strokes representing legs, and a perpendicular one to represent body and tail. The modern form gives an additional parallel stroke, like the word for horse; it is a simple, not a compound character, and when sheep came to be known, instead of making a new character, the sheep was called the "Hun-goat," thus indicating its origin and affinity. *Yang*, goat, is often translated sheep, the earliest instances being found in one of the Odes, wherein the court habiliments of Wen Wang are called "lamb-skins and sheep-skins." This was about 1160 B.C., but it is doubtful if these robes are really the skins of sheep. It is not certain that such was the case, for the skins of goats were used then, as now, for clothes. Hun-goats are not named before the period of the Tang dynasty, say the seventh century A.D. The goat was one of the sacrificial animals, as at present, and was at the first selected for sacrifice when sheep were unknown.

In the discussion which followed, the conclusions of the paper were not accepted by all the speakers; and it was agreed that the subject was one worthy of scholarly investigation.

NOTES AND NEWS.

THE international Statistical Congress, which met at Vienna in October last, selected the city of Chicago and the summer of 1893 as the place and date of their next meeting, and a committee was appointed to draw up a report on the question of emigration, which is to be discussed at that time.

— It is said that two pieces of aluminium can be soldered together with ease by using silver chloride as a fuse. The pieces of metal are placed together in their proper relative positions, and finely powdered fused silver chloride spread along the line of junction, after which the solder is melted on with a blow-pipe.

— Professor E. A. Fuertes, director of the New York State Weather Bureau, Ithaca, offers to send telegraphic notice of cold waves to such persons in New York State as will display the regulation signals for the benefit of the public. This bureau works in co-operation with the Washington office. A limited number of flags will be furnished by the Ithaca office, and those applicants who cannot be thus supplied will be given a list of dealers from whom the flags may be obtained. The flags, which are of bunting material, may also be made by the persons using them.

— A mine of coal of very fair quality for steaming purposes has been found by accident in the Straits of Magellan, according to *Engineering*. Signor Fossetti, the captain of an Italian steamer, was compelled to anchor in Shagnet Bay to make some repairs, and while there he discovered coal very near the surface. Reaching Valparaiso, he sent a corps of experts to the scene of the discovery in a steam launch, who found that the coal was not only abundant but of excellent quality. The importance of the discovery to the commerce of the world can only be appreciated when it is considered that all steamers passing through the Straits of Magellan are required to coal there, and that the supply has heretofore been brought from Cardiff, Wales.

— According to observations made at recent meetings of the Berlin Medical Society, it would seem that the epidemic of influenza began there during the first week of November, the earliest cases admitted into hospital having come under treatment on Nov. 7. Ruhemann stated that the most noticeable difference between this and the other recent epidemics has been the large number of women and children, and the small number of outdoor workers attacked. Guttmann mentioned an instance in which the admission of a single patient suffering from influenza was shortly followed by the occurrence of 13 fresh cases. Fränkel, who took notes of 138 cases, found that only 9 (6.5 per cent) had suffered from the disease before. The chief complications have been pneumonia and heart failure. The effect on the death-rate in Berlin has not been so marked as during the last epidemic, but it has been considerable (27 per mille as compared with an average of 18). In other parts of Germany the effect has been more marked; thus official statistics show that the death-rate has been doubled, or nearly doubled, in several towns. It rose, for instance, to 44 in Posen (average 21), to 45.6 in Frankfort-on-Oder (average 23.2), in Bremen to 34.3 (average 17.1), and in Rostock to 33.5 (average 15.6).

— The citizens of New York, in 1892, propose to celebrate the discovery of America in their own way, assisted by representatives from every State and territory in the Union. A great food show is to be held at Madison Square Garden in October of that year. It is proposed at this exposition to show the progress made by this country in the last four hundred years as regards our food supply. The United States is the greatest food-producing country in the world, and as food is the one thing above all others that first claims the attention of the human family, it is safe to predict that the coming exposition will prove one of the most interesting events of the century. Only food products will be allowed on exhibition, exhibitors being restricted to manufacturers or producers, no dealer as such being allowed to participate. Every article of food exhibited must bear the bona fide name and address of manufacturers, all fictitious brands being rigidly excluded. Liquors, specifics, and patent medicines will not be allowed. Every manufacturer exhibiting must guarantee that his goods at the exposition are the same as offered for sale to the public. Further information may be obtained of the Food Manufacturers' Association, Hudson and Harrison Street, New York City.

— The United States consul at Bordeaux gives, in a recent report, some interesting information about the wines of the Medoc district. He notes that this district, between the sea on the one hand and the Garonne and Gironde Rivers on the others, is called Medoc (*quasi medio aquæ*), because nearly surrounded by water. It is the northern termination of the extensive tract of sand hills and marsh-land called "Les Landes," extending from Bayonne north, which changes to a bank of gravel on approaching the left bank of the Garonne, and contains some of the most precious vineyards in the world. The soil is of light pebble, and, indeed, on the spots where some of the best wine is produced it appears a mere heap of quartz mixed with the most sterile quality of earth. The best wine is not produced where the bush is most luxuriant, but on the thinner soils, where it is actually stunted, and where weeds disdain often to grow. Here the vine retains the sun's heat about its roots after sunset, so that its juices are matured as much by night as by day. The accumulation of sand and pebbles of which this soil is composed is apparently the spoils of the Pyrenean rocks, brought down by the torrents tributary to the Garonne and other great rivers, and deposited in former ages on the borders of the sea. At a depth of two or three feet from the surface occurs a bed of indurated conglomerate, which requires to be broken up before the vine will grow.

— *Nature*, Jan. 21, contains some extracts from a valuable report by the French agent at Victoria on the salmon industry in British Columbia. Among the details noted by him is the fact that the best fish are almost always taken on the outflow of the river in the place where the fishermen endeavor to meet the fish on their arrival from the sea. A boat is often filled with several hundred fish in a single drift net of from 400 to 500 metres. It is calculated that on certain days the total of the Fraser fishery amounts to not less than 150,000 salmon, which are passed through all the different phases of preserving, and are ready to be forwarded for the market on the same day. An ingenious apparatus used to take the salmon, chiefly on the Columbia River in the United States, is described. A large wheel, fixed at a certain distance from the bank, is put in motion by the current. The blades of this wheel are provided with a network of iron wire intended to raise from the water any large object coming in contact with them. A sort of bar-work starting from the wheel is so placed as to increase the strength of the current in such a manner as to force the fish passing on this side of the river to go in this direction. The salmon, wishing to cross the very rapid stream where the wheel is placed, is raised out of the water by the iron wire on the blades. In the rotary movement the salmon is carried to the centre of the wheel, whence an inclined plane conducts it into vast open reservoirs placed in the stream, where it can be kept alive for some time. A system of pulleys provides for the raising of these reservoirs, the water flows out, and the salmon is carried in boat-loads just as it is required for preparation.

— A new instrument, called the "schiseophone," lately invented by Captain de Place (a French officer), is described in *Engineering* The object of the instrument is to reveal the presence and the place of any blow-holes, flaws, cracks, or other defects which may exist in the interior of a piece of metal. When these defects are very great, the blow of a hammer on the piece of metal soon betrays their presence, but for small blow-holes, although these may also be very dangerous, there is not enough difference in the sound given by the hammer striking the piece of metal for it to be detected by the ear. The schiseophone, however, will enable that difference to be heard. The apparatus consists of a pin which runs through a microphone of a special construction, which, as usual, is put in connection with the current of an electric battery. Without giving more details of the complicated mechanism of the instrument, one can understand that, when the pin strikes on a good part of the metal tried, a sound is produced, the vibrations of which affect the electric current in a certain way and then a certain sound can be heard in the telephone attached to the instrument. When the pin strikes on a part of the metal where there is a defect, the sound produced is different; the microphone, the current, and the telephone are then affected differently, and the defect existing in the metal is revealed by the difference in the sound heard at the telephone. The ear must, of course, be used to the different sounds to be able to distinguish them; but the necessary skill is not very difficult to acquire. Trials with this instrument have been carried out at Ermont, at the works of the Northern Railway Company of France, in the presence of many engineers, to find defects in the rails. The telephone of the apparatus was placed at a long distance from the rails, from which it was also separated by a wall. The points where the instrument intimated a defect in the metal were carefully noted; the rails were then broken at those places and the defects were actually found.

— The great Australian expedition has succeeded in traversing, from north to south, the first or most southerly of the three great blanks it was commissioned to explore. This is the wide interior space lying between the track of Forrest in 1874 and that of Giles in 1875. The party crossed the boundary between South and West Australia, at a point to the east of Fort Müller, in latitude 26° 10′ south and longitude 128° east, and struck south across the desert from Mount Squires, making for Queen Victoria Spring, on Giles's track of 1875. Arriving at that expected abundant water-supply, they found it nearly dry, and all hopes of a thorough exploration of the region were destroyed. Under these circumstances, and sorely straitened for water, a direct route was taken for the nearest cattle stations, near the southern seaboard of West Australia and Esperance Bay, from which latter port Mr. David Lindsay, the leader, despatched reports of the expedition to Adelaide in October last. The country traversed appeared to have had no rain for two years. Owing to admirable management on the trying march of 560 miles through an almost waterless country, the health of the party had not suffered, and only two of the camels had died. Notwithstanding the utter aridity of the region, Mr. Lindsay remarks that it cannot be called a desert, for the country is more or less clothed with bushes and trees, and for many miles there is a gum-tree forest which extends into South Australia, the trees reaching often three feet in diameter and forty to fifty feet in height. He adds that the clean white trunks and dark-green tops of the trees from a short distance present a charming aspect, but that a nearer examination reveals the usual signs of aridity, the ground being covered with nothing but the desert-loving spinifex and useless shrubs. Mr. E. A. Wells, the surveyor of the expedition, reports that the whole of the country travelled over from Mount Squires was inhabited by natives who got their water-supply partly by draining the roots of certain mallee trees, some of which, distinguishable only by the keen observation of a native, yield quantities of pure water. It was Mr. Lindsay's intention to remain near the south coast for some weeks to restore the strength of the sorely-tried camels, and then to proceed again towards the interior, taking a more westerly route, so as to cross Giles' route at Ullaring, and Forrest's track at Mount Ida, and thence on to Hope's Station *via* the new gold fields. From the last-mentioned place he had hopes of making an excursion south-east as far as latitude 28°, and thus completing sufficiently the examination of the first great area it is the object of the expedition to explore, before proceeding to the second, further north.

— A magnificent diamond, a perfect octahedron, weighing 205 karats, has been purchased from a river digger by a Kimberley buyer, says the *South African Mining Journal*. It is the second largest stone ever found in the Vaal diggings, the largest being the celebrated Spalding diamond of 280 karats, but which was yellow and of bad shape. The price paid for the stone recently found is said to have been £2,000; since his return from the river the buyer has been offered £8,000 for it, which offer has been refused.

— The *Engineering and Mining Journal* of Jan. 30 gives an abstract of a paper by N. Lebedieff on a direct process for producing iron and other metals from their ores. According to this method the metallic oxides are brought in contact with a strong base (potash, soda, lime, or dolomite) by either melting the two in a finely divided state or by roasting such mixture in furnaces provided with a powerful air blast, stirring the mass frequently. To hasten the process common salt or nitre may be added to the roasted mixture. Some combinations of metallic oxides with alkalies may be produced by the wet process; for example, alkaline aluminates. Abstracting the pure metals may then proceed in cupolas, open hearths, or in crucibles in reverberatory furnaces. To the mixtures prepared as above are added charcoal, coke, etc., as well as a proper amount of silicious materials to produce slag upon the reduction of the metals. In order that furnace walls be not attacked the inner lining is best made of neutral material. In the reduction of iron and other metals easily separated by coal, etc., gas, under proper pressure, containing a sufficient amount of CO_2, H, or C_4H_6 may be used instead of coal, etc. Smelting is then carried on in open hearth or reverberatory furnaces. The reducing gases are brought into the molten mass by pipes discharging at a proper height, or by tuyères issuing from chambers in the furnace walls, and connected with pressure generators or gasometers. After properly heating the furnace the carefully mixed oxides and bases, or the oxides previously treated with bases, are introduced and heated until thoroughly melted, when the reducing gases are allowed to penetrate the mass. In proportion to the relative reduction of the metal and separation of the bases a further thin layer of oxides is added. These latter combine readily with the free base and melt, and the gas then again reduces the metal, the base is again separated and thus the process continues. In case the oxides combine readily with the bases by simple smelting the operations can all be carried on in one furnace. Metals melting easily are tapped from time to time as they are produced. Metals which are refractory, such as iron, chromium, etc., can be dosed with materials which lower their melting point (high carbon pig in the case of iron), or else they are treated, after a sufficient quantity has been produced and removed from the furnace, with water or acids after cooling, thereby dissolving the alkaline salts, the insoluble metal remaining undisturbed in the shape of small plates.

— Dr. Charles S. Edwards, fellow in Clark University, Worcester, Mass., has been appointed assistant professor of biology in the University of Texas.

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INDIAN OCCUPATION OF NEW YORK.

WE have not learned all that will some day be known of the aboriginal occupation of New York, but occasional contributions or systematic statements have a present value. We are thankful for much that has been written, and only wish that more had been done before so many works were obliterated and relics destroyed.

It is quite likely that erroneous estimates have been made in regard to some remains, for fewer occupied spots have been overlooked or forgotten than would be supposed. I have consulted all accessible authorities, certainly the most important, and find less than one hundred and ninety defensive earthworks described or even mentioned, while of stockades which have left traces there are between twenty and thirty. We know that more of the latter were in use, from history; but there are special reasons why the traces of these were fewer than of earthworks. A liberal allowance for undescribed or indefinitely mentioned defensive banks might bring this class of fortifications up to two hundred and fifty, which is probably a fair allowance for the State of New York. It is to be remembered, however, that some have been reported where none existed, and that others have been confused. It is not my purpose now to point these out. With a considerable outlay of field and home work during many years, I have collected notes and collated accounts, so that I have on the map before me a pretty fair view of the field of Indian occupation in New York. In the central part of the State very few sites have escaped my attention, even when small, and this long continued study presents some curious results.

My present intention, however, is merely to show the grouping and nature of the more important known works, although by far the finest articles of stone have come from open villages, hamlets, and camps occupied by early travellers, fishermen, or hunters. The fort builders here had in a measure left the stone age behind them, and stone gouges, gorgets, amulets, and kindred articles, are to be looked for where camps or unenclosed villages stood. The fort builders preferred working in clay, bone, and horn, using no flint scrapers or drills, and even making stone arrows somewhat sparingly.

When known sites are placed on the map, especially when unimportant ones are eliminated, it will be found that there is a very distinct arrangement in groups, nor does the presence of even small camps change this materially. Hunters, of course, camped on most large streams and lakes, but the rivers had the larger number. Defensive works are oftener at some distance from navigable waters, though having a tendency to the sides of broad valleys. It will be found that some counties present scarcely a trace of settled occupation, while others have them in abundance.

One large group lies in the south-west part of the State, where Cattaraugus County has eleven defensive earthworks mentioned, with others undescribed, and also at least ten burial mounds. Chautauqua has even more abundant remains of this group, having forty-four earthworks and fifteen burial mounds of various kinds. There have been reported also seven ossuaries or bone-pits, similar to those found in the Huron country, in Canada. A very few of these defensive works seem to belong to the historic period, containing European relics. With all the descriptions we have of these works, it is a pity that no systematic, and hardly general, report has been made of the articles found, such as has thrown so much light on works further east. In general, the indications seem Iroquoian, though presenting some features of a border land. It is doubtful whether all the works there are of a northern character.

Forming another group, slightly connected with this, Erie County has seventeen earthworks, seven mounds, and four ossuaries. Others have been obliterated before description, but probably not many have escaped mention. The forts are mostly smaller than in the last group. Niagara has three earthworks, six mounds, and four ossuaries. In a general way, the seven earthworks and three mounds of Genesee County may be placed in the same group, and Orleans lies on the border with one earthwork, one ossuary, and traces of works now obliterated. In this group are found many quite recent villages, especially of the Iroquois. Most of the remains, however, are prehistoric, the Eries and Neutrals barely coming in contact with the whites.

In the territory further east, acquired by the Senecas in the seventeenth century, recent villages predominate, but the broad valley of the Genesee has many prehistoric sites, mainly grouped towards the mouth of the river. Monroe County seems to afford twelve earthworks, one recent stockade, and twelve mounds; Livingston County, eight earthworks, one stockade, and twelve mounds, some of these being recent. Wyoming County has one small earthwork and one mound. Ontario County has two earthworks and three stockades, part of both these being recent, as are most of the village sites and burial places. Yates has two earthworks described and some indefinitely reported. One other, planned and described, is evidently erroneous. Tompkins has four earthworks, one in combination with a stockade, and all prehistoric. Allegany has three earthworks and some recent Seneca villages.

Between this and the Cayuga group there is a less distinct line. Seneca County belongs to this, but has but two earthworks described, though reference is made to others by DeWitt Clinton. Wayne has one very small work, in good preservation. Cayuga has five earthworks, part of them recent, and three early stockades. It abounds in recent villages, whose stockades, if there were such, have left no traces. Strictly, a part of the earthworks in the western part of Onondaga County belong to this, though forming a small group by themselves. For present purposes it is easier to class them with the next.

The Onondaga group, which I have long studied in all its parts, is of high interest. The Elbridge earthworks, to which I have alluded, are all prehistoric, and are allied to another small group towards the Oswego River. These are circular, and between them occurs a small group of circular stockades, near the Seneca River. All are of Iroquoian character, yet very different from the forts of the Onondagas, who settled in the south-east part of the county three hundred years ago. This county affords seven earthworks, eight stockades, and two burial mounds. The earthworks and stockades are both early and recent, the later stockades being generally angular. Part of Madison County belongs to this group, and in this is found the earliest fort of the true Onondagas, occupied about A.D. 1600. Oswego County forms part of the same group, but has few villages. Three earthworks and one mound occurred near the Oswego River.

The Oneidas occupied Madison more than Oneida County, and in the former have been reported one earthwork and five stockades. Some historic forts may have left no traces. There are many recent villages, but few early. Oneida County affords few remains, though there are some early hamlets north of the Mohawk and west of Utica.

The Mohawk group is mainly in Montgomery county, with one large village in Fulton, of about A.D. 1600, one of the two earliest Mohawk towns. In Montgomery there are some early camps and one earthwork. All the villages except the last mentioned are recent, but the traces of their stockades are lost. The earthwork seems barely prehistoric.

The Jefferson County group is strictly prehistoric, and may be compared with the Chautauqua. It seems to have been the early home of the Onondagas, the Mohawks coming from lower down the St. Lawrence. There are thirty-three earthworks, two burial mounds, and six ossuaries, besides obliterated sites. The mounds reported at Perch Lake are foundations of circular lodges.

A smaller group is in St. Lawrence County, where there are eight earthworks, and possibly related to these are a few nearly opposite in Canada. These two small groups, however, are quite a distance apart.

Detached from these groups, Chemung, Chenango, Otsego, Suffolk, and Tioga, have one earthwork each, and Delaware three. Queens has two stockades, and there are historical notices of many stockades along the Hudson, of which no traces remain. Chenango County had one mound, and Franklin two. Columbia and some other counties had stone heaps accumulating within historic times. The remaining counties have sometimes points of archæological interest, but mainly in a minor way.

It must not be supposed that groups of works indicate always a number of contemporaneous villages, though this was sometimes the case. The Hurons, in Canada, had many towns; so had the Eries and Senecas in New York. The Onondagas, however, had generally one large and one small village at a time, and this was the case with the Oneidas. The Mohawks commenced with two, but soon had three or four. These were often removed, and a number of forts will often show the line of a nation's march.

As far as the interior of the State is concerned, early travel followed the valley of the St. Lawrence in the main, often at a considerable distance from the great lakes and river. The Mohawk valley was little frequented by early travellers. When they reached the west end of Oneida lake, coming eastward, they bore to the north, passing down the St. Lawrence, and sometimes into Lake Champlain. Better fishing and hunting may have caused this. For southern visitors, the Susquehanna afforded a convenient channel, and eventually the tide of Iroquois migration flowed southward through its valley, founding forts in many parts of the Keystone State. A thousand years ago, however, New York may have had few inhabitants, if any, west of the Hudson River Valley, but was a grand resort for fishermen and hunters.

W. M. BEAUCHAMP.

THE SUPPORT OF MUSEUMS.

THE utilitarian tendency of the American mind and habits of life undoubtedly often stand in the way of that broader culture and advancement, the absence of which in us calls for occasional sneers from our transatlantic cousins. "What is the good of it?" a query which demands an answer setting forth immediate returns that can be expressed in money values or equivalent gain, is too often on the lips of those best able to aid inquiry and research which, for the nonce, appears to have no direct bearing on the physical welfare of mankind.

These thoughts are occasioned by facts that have but recently come to the knowledge of the writer regarding the comparatively very limited means at the command of most of the leading museums of natural history in this country. A gentleman, interested in scientific research, well versed in certain departments, having looked the geographical field over, and coming to the conclusion that certain headwaters of the Amazons at present afford the most unknown and unexplored tropical territory now remaining on the globe, decided to give a year or more of his life to exploration in that field. Willing to cast his lot with the natives, to undergo all forms of deprivation familiar to such travellers, that his expenses might be reduced to a minimum, it seemed to him that there should be no difficulty in obtaining the amount of the bare cost of his journey and the transportation of the trophies and valuables he would be able to gather, from some museum in exchange for his entire collections. In his own case, such credit as he might win by scientific and other publications announcing the facts of his discoveries, was quite all that he cared to ask in return for months, perhaps years, of trial and hardship such as few can appreciate and still fewer are able to endure.

Yet, such is the present impecunious condition of the leading museums in our great cities, that after four months of effort in that direction the would-be explorer has been forced to confess his inability to make arrangements that would enable him to go out under these auspices; and the result must now be, what it has so frequently been before, that his material, with all its wealth of truths for the zoologist, botanist, ethnologist, and physicist, will go to London, Berlin, or Vienna. How much longer are Americans going to allow their self-denying scientific enthusiasts to be thus weaned, in deed if not in mind, from their natural desire to contribute to their home museums the results of their discoveries?

This evil does not cover only the field of foreign travel and research. When sums that many men now consider small to be set aside for an evening's reception or entertainment are not forthcoming in New York to purchase for her museum such treasures as the Grote collection of North

American Lepidoptera, which, with its untold wealth of type-specimens and uniques, went to the British Museum, or the Scott collection of the birds of Florida, the result of several years of patient toil on the part of a skilled ornithologist, which found its way into the same mighty storehouse, it can be imagined how quick European science is to profit by this display of parsimony in America.

To recur to the case of the Amazonian explorer, this present apathy can best be shown by quoting from a letter which has just been written to him by one of the gentlemen prominently connected with the American Museum of Natural History in Central Park. After stating that the authorities of the museum appreciate the "advantages to the museum" of the proposition made them, he adds that they "felt it would be impossible to meet its requirements;" yet these requirements were simply that a sum of but a few hundreds of dollars be raised for this purpose. After stating that "the trustees are already overburdened with the load of extra expenditures they have to meet from their own pockets to equip the new exhibition halls," the writer continues, "it would not be practicable for the present to co-operate with you in your very laudable enterprise. . . . Your case, however, is only one out of a score or more of a somewhat similar character which have ended in a similar way — greatly to the disadvantage of our museum."

This is a dark picture, coming as it does from the nation's centre of wealth and business energy, but it is, unfortunately, only a sample of what is of almost monthly occurrence in one or the other of our larger cities. The occasional exception to this, which has made possible the infrequent dispatching of small expeditions, but emphasizes the general rule. Our museums are carried on, made possible, in fact, by the self-denial and enthusiasm of men who, after spending years in attaining a degree of special knowledge fitting them for their scientific positions, are yet willing to accept salaries that would be spurned by book-keepers and country parsons, that they may continue in touch with their chosen walk in life. The idea so prevalent among successful business men that such specialists are as a rule visionaries who are, by the very nature of their long scientific training, unfitted for any other life, is found on the most cursory examination of the facts to be erroneous. The researches of Henry in electricity, of Langley in ariodynamics, of Goode in icthyology, or Riley in entomology, to take examples from one museum, are none the less practical and of incalculable value to the public, given free to the world as they are, than they would be if they had been protected by ample patents and had yielded their discoverers great financial returns in place of the plaudits of their fellows, best able to appreciate their work, with the which they have been willing to rest content.

It is time that more of our moneyed men were brought to regard this subject in a different light. The country naturally, and with right, looks to New York to set the example in this direction of larger aid for public museums of natural science.

EUGENE MURRAY AARON.

ASTRONOMICAL NOTES.

MR. BERBERICH of Berlin has recently called attention, in a letter to the editor of the *Astronomical Journal*, to some interesting facts connected with the periodic comet discovered by Wolf in 1884. He gives an approximate ephemeris for the return of the comet in 1898, as it will not be greatly perturbed in the interval. From these data it appears that the comet will be favorably placed for observation during its next return. In following returns the comet will not be so favorably placed for observation. As seven revolutions of the comet are nearly equal to three of Jupiter, a second approach of the two bodies will occur in 1922–23, which will probably deprive us of a view of this comet for a long time, and perhaps forever.

Again the telegraph flashes the announcement of the death of another eminent English astronomer and mathematician, Professor J. C. Adams. To Professor Adams is due the grandest work ever performed for astronomy by the human mind — the discovery by mathematical reasoning of our outermost planet, Neptune. At another time we hope to be able to give the readers of *Science* a sketch of his life.

The Sidereal Messenger, which has for the past ten years been published by Professor W. W. Payne, at Northfield, Minn., has been greatly increased in size, and in the future will contain not only subjects in general astronomy, but will take up the subject of astrophysics. In the January number of the magazine will be found the photographs of prominences upon the sun, obtained by Mr. Hale of Chicago. That gentleman will have charge of the astrophysical department of the magazine.

In No. 253 of the *Astronomical Journal* Professor A. Hall gives the result of his discussion of the observations made of Iapetus, the outer satellite of Saturn, made with the large equatorial at the Naval Observatory. The resulting elements for Iapetus give for the mass of Saturn

$$M = \frac{1}{3485.7 \pm 1.28.}$$

The following is a continuation of the ephemeris of Winnecke's comet, which is now due. The epoch is for Berlin midnight: —

	R.A. h.	m.	s.	Dec. °	′
Feb. 6	12	47	23	+17	0
7		47	55	17	13
8		48	26	17	26
9		48	55	17	39
10		49	23	17	52
11		49	49	18	6
12		50	14	18	21
13		50	37	18	36
14		50	39	18	51
15		51	19	19	6
16		51	38	19	22
17	12	51	55	+19	39

G. A. H

HAINAN.[1]

THE great island of Hainan, off the south-eastern coast of China, is but little known to Europeans, although since 1877 there has been a treaty port there. Mr. Parker, the Consul at Kiungchow, the port in question, lately made a short journey in the interior of the island, of which he gives some account in a recent report. He travelled about sixty miles up the Poh-Chung River, to within a mile or two of Pah-hi, which is, at most seasons of the year, considered the limit of navigation for all but the smallest craft. He walked round the walls of Ting-an city, one of the disturbed districts during the recent rebellions, on New Year's Day (Feb. 9); they are just one mile in circuit, and differ little from those of other

[1] From Nature.

Chinese cities. Wherever he had an opportunity of walking diametrically across lengthy curves of the river he found the inclosed area to be extremely well cultivated; though not so flat, its general appearance recalled many features of the Tonquin delta, especially in its great wealth of Bamboos. The productions of the soil are much the same, the papaw, areca-palm, sweet potato, turnip, ground-nut, orange-tree, etc.; but a peculiar Hainan feature is the cocoa-nut palm. Another peculiarity of this region is the ubiquitousness of the dwarf *Pandanus*, probably the same as the *P. odoratissima* of Fiji, the fibre of which is used in the manufacture of grass-cloth, and is usually known to foreign trade here as hemp. Much of the land was under sweet potato cultivation, and every household seemed to possess a few pigs, of the very superior and stereotyped Hainan variety, black as to the upper and white as to the lower part of the body, with a dividing line of gray running along the side from the snout to the tail. These wholesome-looking pigs are fattened on the sweet potato, and do not rely for sustenance upon precarious scavengering, as is the case with the repulsive and uncleanly animals of North China. Land contiguous to the river is irrigated by enormous wheels, forty feet in diameter, of very ingenious construction, moved by the current, needing no attention, and discharging perhaps one hundred gallons of water in a minute into the trough above, day and night without intermission. He passed several large pottery establishments; but, as at the New Year all business and cultivation are suspended for a few days, the opportunity was not a very good one for gathering precise information. The temperature during the week ranged between 50° and 69° F. Game seemed plentiful everywhere, and he mentions that a German resident has recently made a very fine collection of about 400 Hainan birds, embracing 154 species, which will shortly be on their way to a Berlin museum. One of the commonest birds in the river is a spotted white and black kingfisher of large size. Amongst the trees which attracted his attention was one locally called the "great-leaved banyan," which looks remarkably like the gutta-percha tree: the natives seem to use its gum mixed with gambier, in order to make that dye "fast;" but there is some doubt whether it is not the sap of the real banyan-tree which is used for the purpose. A very strong silk is made from the grub called the "celestial silk-worm," or, locally, "paddy-insect." This grub is found on a sort of maple. When full-grown it is thrown into boiling vinegar, on which the "head" of the gut, or "silk," appears; this is sharply torn out with both hands, drawn apart, and is as long as the space between them, say five feet; it is so strong that one single thread of it is sufficient to make a line with which to catch the smaller kinds of fish.

SERICULTURE IN ASIA MINOR.[1]

In May, 1885, the writer was enabled, from personal observation on the spot, to report upon the silk harvest of Bournabat, near Smyrna, Asia Minor, which report was printed in the *Journal* (Vol. XXXIII. p. 852). The sericultural industry was then in a state of slow revival from a condition of almost utter collapse, caused by the deadly effects of the various silkworm diseases which had long devastated, and nearly ruined, the "magnaneries" of France and Italy. Subsequently, in 1887, in an extended and illustrated form, the report was reproduced, with additional sericultural and other information, in the volume entitled "Pen and Pencil in Asia Minor," published by Sampson Low & Co. On both these occasions the writer endeavored to interest the public in the story of an effort, on the part of an English gentleman, to benefit the Turkish peasantry and revenue of the country, which had more of the romantic element in it than is usually to be found in ordinary industrial operations. For nearly half a century Mr. John Griffitt of Bournabat, a village near Smyrna, has devoted most of his leisure hours, well seconded by his accomplished Greek wife, to combatting the maladies of silkworms, experimenting with the various known races, and endeavoring to improve the quantity and quality of their silken produce. Long before M. Pasteur, the distinguished French physiologist, took the field, Mr. Griffitt had been working at the same problems, the solution of which brought the great Frenchman afterwards so much well-deserved honor; but while the one was rewarded the other has hitherto been neglected. The first enjoyed the wealth and influence of his Government to encourage him in all his efforts; the second has had to struggle on unaided throughout his long career of philanthropic endeavor against the inertia of sluggish or hostile officials, the childishness of a prejudiced peasantry, and a horde of unscrupulous native and foreign parasites, ever ready to appropriate his methods without acknowledgment, to claim or dispute his discoveries, and to defraud him in every possible way. From the first, Mr. Griffitt welcomed and applauded the remarkable results of M. Pasteur's investigations, and became his acknowledged disciple; but, being himself a practical silk-farmer, which M. Pasteur was not, was soon in a position to shoot ahead of his master, to modify, supplement, and stamp with his own genius many of the suggestions of the great chemist, for which he never received either credit or reward. Probably in no other country in the world except Turkey could a native, or even a foreigner, accomplishing the revival of a staple industry, as Mr. Griffitt has done, have escaped recognition, or being loaded with honors. He has rescued sericulture, upon which so many thousands, perhaps millions, depend in Turkey, from extinction, and been a means of replenishing the usually collapsed Ottoman exchequer, and enabling the Porte to offer British bond-holders — if it chooses to do so — substantial dividends instead of polite excuses.

Still more recently the writer had a paper in the *Journal* of Aug. 23, 1889 (Vol. XXXVII. p. 772), when further information was given regarding Mr. Griffitt's continued successes, particularly in open-air sericulture. On the present occasion he would add the latest facts, which are quite as interesting as those already communicated.

At the beginning of 1891 a report by the "Chambre des Deputés" was presented to the French Government, in which it was said that sericulture was not progressing in France in consequence of the reappearance of the dreaded disease known as "flacherie," along with some minor maladies, and that the nurseries were being decimated. M. Pasteur's discoveries had enabled the silk-farmers to vanquish the other distemper, "pebrine," but "flacherie" was working havoc everywhere, so a grant of several millions of francs was asked to be expended in trying to crush the disorder.

Meanwhile, Mr. John Griffitt, with no Government money or help of any kind, had thoughtfully built up a system of scientific silk farming at Bournabat, near Smyrna, in which he combined the most notable of M. Pasteur's discoveries with the invigorating method of M. Roland of Switzerland, and his own experiences, with the result that his worms acquired such robustness that he had had no deaths among

[1] From the Journal of the Society of Arts.

them for years, while all the races subjected to the process yielded a larger crop of better silk than before. So marked was this improvement that a comparison will show it at a glance. In the first report, already alluded to, made in 1885, Mr. Griffitt's yield of cocoons — considered a splendid return at the time — was 78 kilogrammes (171 pounds avoirdupois) per ounce of eggs set to hatch, while in 1890 the harvest was 91 kilogrammes (200 pounds) per ounce of eggs. These figures have been vouched for by M. E. Charmand, chief of the Smyrna branch of the "Direction Générale de l'Administration de la Dette Publique Ottomane, à Constantinople," who reported his observations, gathered from time to time in Mr. Griffitt's factory at Bournabat, to his superiors at the Turkish capital.

Following up these efforts, and stimulated by the ill-success of the French sericulturists, Mr. Griffitt last year achieved an additional triumph, his latest crop showing an advance to 92 kilogrammes (202 pounds) of cocoons per ounce of eggs. This harvest had likewise been watched through all its stages, and reported upon to the Constantinople authorities by the same gentleman already named, who added that as the yield from foreign eggs had been *nil* at Bournabat, their importation into Turkey ought to be stopped.

It will be evident to the readers of the above and former communications that Mr. John Griffitt's single-handed and almost phenomenal success in sericulture, in the face of the utter failure of the best silk-farmers of France, point to Bournabat as the future sericultural school of the world, and as the *entrepot* for robust graine. If further figures be required, they are to be found in the circumstance that during the last four or five years the finest French eggs hatched at Bournabat have only yielded from 10 to 12 kilogrammes (22 to 26 pounds) of cocoons per ounce, as compared with Mr. Griffitt's 92 kilogrammes (202 pounds) per ounce of eggs; while last season, according to M. Charmand, the French eggs laid out at Bournabat did not hatch at all.

William Cochran.

Overdale, Dunblane, Perthshire.

MR. KOEBELE'S SECOND TRIP TO AUSTRALIA.[1]

We have not yet mentioned in these pages the fact that Mr. Koebele has been sent out to Australia and New Zealand a second time on a search for beneficial insects. The California State Legislature last winter appropriated $5,000 for sending some one to Australia for this purpose, and this sum was placed at the disposal of the State Board of Horticulture. The board soon afterward made application to the Secretary of Agriculture to have Mr. Koebele sent, placing the entire appropriation at the secretary's disposal. To this proposition the secretary assented on condition that Mr. Koebele should go under instructions from the department, his salary as an agent of the division of entomology being continued (his expenses only to be paid by the State Board of Horticulture), and that his report should be made to the Department of Agriculture, the desire being to co-operate as far as possible with the board. Accordingly, such instructions were given as seemed best to promote the object in view, cautioning Mr. Koebele particularly to run no risk, in his sendings from Australia, of importing with the beneficial insects any injurious species not now existing in the United States which it might prove disastrous to introduce, and taking advantage of the occasion also to have him make every effort to collect in California certain beneficial species to take with him to Australasia, indicating such species as prey upon cosmopolitan insects or species which the colonies mentioned have derived from America.

Mr. Koebele sailed on the August steamer, stopping at Honolulu and Auckland, and arriving at Sydney the latter part of October. At Honolulu he left a number of living specimens of *Chilocorus bivulnerus* in the hands of our correspondent, Mr. A. Jaeger, and secured while there four species of lady-birds, of which he sent small numbers to California by steamer. These were sent for use against the black scale (*Lecanium oleæ*). He also found a few parasitic Chalcididæ on an undetermined Lecanium, and of these he also sent a few specimens. Upon his arrival in New Zealand some of the lady-birds which he had taken with him were alive and began to feed at once upon woolly aphis. Some syrphus flies and lace-wing flies were also in good condition, as were also the larvæ of the Rhaphidia, which feeds upon the codling moth. These were left in competent charge. Specimens of *Scymnus acceptus*, *S. consor*, *S. villosus*, *S. flavihirtus*, and *S. fagus* were collected and sent to California. These all prey upon various species of scale insects, but it is hardly to be supposed that they will accomplish any better results in California than do our native species of this genus, all of which have a similar habit.

The most encouraging information comes to us under date of Nov. 1 from Sydney. He there finds that *Orcus chalybeus*, a steel blue lady-bird, is a most important enemy of the red scale. He has found them by the hundreds, and has observed the mature insects eating the scales. All of the trees were "full of eggs," and the larvæ were swarming upon all the orange and lemon trees infested with the red scale. He secured and sent a large lot of the eggs and many of the adult beetles. He also sent the allied *Orcus australasiæ*, also found feeding upon the red scale, and a number of scymnids, one of which was very numerous, feeding upon the same scale-insect. Another species was found feeding mainly upon the flat scale (*Lecanium hesperidum*) and the black scale (*Lecanium oleæ*). He also forwarded a number of *Leis conformis*, which, as stated in Bulletin No. 21 of this division, is the commonest enemy of the woolly root-louse of the apple. Unfortunately Mr. Koebele does not state whether the three insects mentioned as feeding upon the red scale were successful in holding that destructive insect in check, and upon this point naturally depends much of their value to California. Our agent at Los Angeles, Mr. D. W. Coquillett, has been instructed to spare no pains to properly care for and colonize whatever may be received from Mr. Koebele, and is fully prepared to do so. This large sending arrived at Los Angeles, we are sorry to state, in rather bad condition. Twenty-eight beetles, however, were alive, including nine of *O. chalybeus*, and no effort will be spared to keep them in good condition and to induce them to propagate.

[1] From Insect Life for December, issued by the U. S. Division of Entomology.

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.*

On request in advance, one hundred copies of the number containing his communication will be furnished free to any correspondent.

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

The First Locomotive.

I am surprised that your correspondent, "M. H.," in his article in your issue of the 15th, "The First Locomotive Run in America," should have been so mistaken in its name. There is a small town in England which at one time had a great reputation for locomotive building. It is Stourbridge. The locomotive which M. H. correctly states was operated at Honesdale over a half-century ago, was made there. From this fact it was called the Stourbridge Lion, not "Stonebride," as your correspondent has it. This name and the reason for it are very familiar in Scranton, whence I write, but as a clincher, I may say that I recently conversed on the subject with a lady who enjoyed the acquaintance of Mr. Allen, the engineer of the locomotive in question, and from her I once more learned the facts here narrated.

STANLEY M. WARD.

Scranton, Pa., Jan. 26.

A Section of Botany in the American Association.[1]

THE thought of having a section for the botanists in the American Association should be very inspiring to all who have at heart the thorough study of plant life in America. All admit that Section F is now crowded with members and papers, and doubtless many are deterred from taking part in the sessions from lack of opportunity. At the last meeting numerous papers were passed without comment or discussion that the programme might be carried out.

The work of the section has naturally divided itself into two groups, namely, that pertaining to animal life, and to botany. In order to gain more time and draw together more closely those who are interested in particular branches, clubs have been formed. Thus the entomological and botanical clubs have arisen and grown into features of the week of as much importance as the section and more perhaps to the younger members. These clubs should, and doubless will, be continued. In the section itself for years there has been an attempt on the part of the programme committee to group the subjects so that zoologists and entomologists have had a half-day assigned them, alternately with the botanists. This has virtually broken up the continuous attendance of members upon the sectional meetings, and excursions or other events are indulged in by the party not upon the programme. Perhaps to our shame, this has been particularly true of the botanists, who have sometimes left the zoologists with a depleted but more homogeneous and attentive audience. Also within the past few years the plan of having time assigned for a series of connected papers upon one or more of the branches of science coming under the present scope of the section has still further differentiated the work. As Section F now stands its sessions are largely an alternation of groups of subjects with an audience that shifts with the programme.

A notice of an amendment to divide Section F is therefore well founded; the division is very natural and one that, in fact, has already been made, so far as arranging the programme by grouping the subjects and by the work of the clubs will permit it. In short, it has gone as far as it can save by a division of the section itself.

The contemplated division will bring many gains without corsponding losses. Time will then be offered for thorough sectional work upon the two large and growing fields of biological science, instead of the rapid reading of papers, as at present, followed by little or no discussion before a half-interested audience.

With a Section of Botany, for example, officers can be selected who will be interested in all subjects presented, a condition that does not always obtain under the present arrangement, to say nothing about the difficulty that may now arise as to the proper apportionment of the official plums among the aspirants for honors.

If we believe in the principle of division of labor and specialization, in short, in the theory of evolution in its broad and best sense, we cannot but feel that the proposed step is in the direction of advance, and realize that the last few meetings of Section F indicate clearly that the time to take the step forward is at hand.

The best way to make the importance of a division still more emphatic is for every student of the biological sciences to come, if possible, to the Rochester meeting with a large number of full papers, and strive to have as many as possible read and discussed in Section F, the balance of shorter ones to be considered as best they may at the clubs. As a section of botany is asked for, let the botanists in particular show, by their works, their faith in the raasonableness of the demand.

BYRON D. HALSTED.

Rutgers College, Jan 25.

[1] This letter also appeared in the Botanical Gazette.

AMONG THE PUBLISHERS.

THE Regent Street Polytechnic Institute of London proposes to bring over a thousand or more of its young clerks, mechanics, and apprentices to visit the Chicago Exposition; and its secretary, Mr. Robert Mitchell, is about to arrive at New York on his way to Chicago, for the purpose of making transportation and other advance arrangements. Steamship arrangements have already been made. Mr. Albert Shaw, American editor of the *Review of Reviews*, describes in an illustrated article in the February number "The Polytechnic and its Chicago Excursion."

— In the February number of *Babyhood* Dr. William H. Flint discusses the dislikes of children to certain articles of food and the means of overcoming such antipathies. Of equal value to mothers is an article on "Colic," by Dr. C. L. Dodge, in which the causes, symptoms, and treatment of that common ailment are clearly described. "Ought Obedience to be Enforced?" "The Tyranny of Whims," "Talking about Children in their Hearing," etc., are some of the other topics discussed. The medical editor furnishes advice concerning such "Nursery Problems" as the voracious appetite often seen in children, the desirableness of giving fruit to infants, the treatment of eczema, etc.

— Claus Spreckels, the millionaire sugar manufacturer, whose plantations are in the Sandwich Islands, has written to Mrs. Helen Mather that he has carefully read her book, "One Summer in Hawaii" (Cassell Publishing Company), and that he "commends it to the earnest attention and study of all such as are desirous of obtaining a knowledge of the beauties of that comparatively unknown and still less appreciated Paradise of the Pacific."

— The Cassell Publishing Company will publish in February "Across Thibet," by Gabriel Bonvalot, author of "Through the Heart of Asia," with upward of one hundred illustrations, made principally from photographs taken by Prince Henry of Orleans. Of this book the London *Times* says: "M. Gabriel Bonvalot has already achieved a high reputation as a central Asian explorer. 'Across Thibet' is thus recommended alike by the character and literary skill of the explorer aud by the interest and novelty of the regions explored by him. The journey here described was undertaken in the company of Prince Henry of Orleans, son of the Duke de Chartres, and of Father Dedeken, a Belgian missionary, with a rare taste and aptitude for adventurous travel and a keen appetite for sport, and it tried to the utmost the endurance and the enterprise of all three. The copious illustrations due to Prince Henry's camera are full of interest and the translation is excellently done."

— There has just appeared in the "Johns Hopkins University Studies in Historical and Political Science" a pamphlet by Paul E. Lauer on "Church and State in New England." Beginning with the Reformation in England, the author traces the movement of thought on the relations of church and state, first among the Puritans of England and then among their descendants in the New World; and shows how the new ideas of religious freedom expressed themselves in political action, ending with the complete secularization of the state in the present century. The main principles involved and the mode of their application are well shown, and the narrative, though desti ute of imaginative insight, is straightforward and clear. Unfortunately for Mr. Lauer, however, it is all a threshing of old straw. The story he relates has been told so often and so well that this pamphlet is more likely to weary than to interest the reader. Moreover, it is impossible to treat satisfactorily of the relations of church and state in any nation apart from the general religious and political history of the time, so that Mr. Lauer's work is incomplete and fragmentary.

Regarded as a college exercise it deserves cordial praise; but as a contribution to historical literature it cannot be said to have much value.

— In the second of *The Century's* articles on "The Jews in New York," in the February number, social customs, weddings, schools, etc., are treated, and the illustrations include several views of the new Temple Beth-El, the interior of the Progress Club, etc.

— A recent number of "The World's Great Explorers" series (Dodd) is Captain Albert Hastings Markham's "Life of Sir John Franklin." The story of the life of such a man, a skilful sailor, an ardent explorer, an able administrator, and a daring and successful Arctic navigator to whom the world owes, directly and indirectly, its knowledge of a very large portion of the Arctic basin, should not remain untold, especially in view of the meagreness of hitherto published authentic material. The closing chapters, treating of the various expeditions despatched in search of Franklin, contain valuable suggestion and comment as to the conduct of navigators exploring high latitudes. The volume is provided with the maps and charts requisite to intelligent reading, as well as with several illustrations.

— The late Henry Edwards, the actor, wrote more than 150 books, pamphlets and articles, chiefly on topics of Natural History, and all these were published at various times and in various places. Mr. William Beutenmüller, of the American Museum of Natural History, has contributed to *The Canadian Entomologist* (London, December, 1891, Vol. 23, No. 12) a complete list of these writings. It fills more than eight pages, and it is strikingly suggestive of the ample learning and devoted labor of the author, whose place among men of science was even more distinguished than his rank upon the stage.

— In the February *Atlantic*, Professor Rodolfo Lanciani, author of "Ancient Rome in the Light of Recent Discoveries," contributes a paper on "The Pageant at Rome in the Year 17 B.C.," giving the details of some inscriptions very recently discovered commemorating the celebration of secular games under Augustus, for which Horace wrote his famous "Carmen Seculare."

— A new danger threatens English publishers. In future they will have to be careful that the titles of the works they publish correspond with the contents, otherwise they will lay themselves open to a prosecution for obtaining money under false pretences. Such is the lesson taught by a recent decision of Sir Frederick Darley, the Chief-Justice of New South Wales. A Sydney firm issued a work in two volumes entitled "Australian Men of Mark." A subscriber refused to pay, on the ground that his biography was not included in the work, as was promised. The publishers sued him; the Chief-Justice went through the book and declared that no action could lie, inasmuch as the book was not what it professed to be. The people whose biographies it contained had a mere local celebrity in the towns where they resided. They were

CALENDAR OF SOCIETIES.

Philosophical Society, Washington.

Jan. 30.—Joseph LeConte, The Relation of Philosophy to Psychology and to Physiology.

Society of Natural History, Boston.

Feb. 3.—J. Eliot Wolff, the Geology of the Crazy Mountains, Montana; Walter G. Chase, The Scenery, Glaciers, and Indians of Alaska.

Appalachian Mountain Club, Boston.

Feb. 3.—Arthur L. Goodrich, The Waterville Valley; Roswell B. Lawrence, Middlesex Fells; Charles E. Fay, An Excursion Over the Whiteface Tripyramid Ridge.

Wants.

Any person seeking a position for which he is qualified by his scientific attainments, or any person seeking some one to fill a position of this character, be it that of a teacher of science, chemist, draughtsman, or what not, may have the 'Want' inserted under this head FREE OF COST, *if he satisfies the publisher of the suitable character of his application. Any person seeking information on any scientific question, the address of any scientific man, or who can in any way use this column for a purpose consonant with the nature of the paper, is cordially invited to do so.*

WANTED.—Books on the Magic Lantern. Will exchange, "How the Farm Pays," by Cozier and Henderson; "Culture of Farm Crops," by Stewart; "American Agriculturist," 1890 and 1891. I. SLEE ATKINSON, 43 Wallace St., Orange, N. J.

WANTED.—(1) A white man versed in wood and iron working, able to work from specifications and plans, suited for an instructor of boys; his business to have charge of shops of school, outline and direct the work for foremen and students; salary to be $1,000 per annum (nine months). (2) A man (black preferred) to teach the colored, iron working and forging, subordinate to the preceding; salary, $720. (3) A man (white) competent to take classes in engineering (assistant's position), but with the ability to perform any of the work required in any of the ordinary engineering courses of our universities; salary from $1,000 to $1,500. A. H. BEALS, Milledgeville, Ga.

WANTED.—Two or three efficient computers with good knowledge of Spherical Trigonometry and ready use of logarithms, for temporary employment in the office of the Coast and Geodetic Survey. Applicants should furnish evidence of their fitness for the work. Apply by letter to the Superintendent, Coast and Geodetic Survey, Washington, D.C.

WANTED.—*Science*, No. 178, July 2, 1886, also Index and Title-page to Vol. VII. Address N. D. C. Hodges, 874 Broadway, New York.

WANTED.—A position in the philosophical or pedagogical department of a college or university by a young man (30) who has had five years' practical experience in teaching, and who has done four years' post-graduate work in philosophy, devoting his attention during the last two years especially to study and original investigation in scientific psychology and its applications in education. Address E. A., care *Science*, 874 Broadway, N. Y. City.

WANTED.—A suitable position in Washington, D. C., not connected with the Government, and with a salary not to exceed $650 a year, by an experienced biologist with six years' university training. Applicant has been a skilful surgeon for fourteen years; is a practical photographer, cartographer, and accustomed to the use of the typewriter. He is also capable of making the most finished drawings, of any description, for all manner of illustrative purposes in science; trained in museum methods and work; also field operations and taxidermy in its various departments, and modeling, production of casts, restorations of paleontological specimens and similar employments. Address U. S. R., care *Science*, 874 Broadway, New York.

Exchanges.

[Free of charge to all, if of satisfactory character. Address N. D. C. Hodges, 874 Broadway, New York.]

Wanted, in exchange for the following works, any standard works on Surgery and on Diseases of Children: Wilson's "American Ornithology," 3 vols.; Coues' "Birds of the Northwest" and "Birds of the Colorado Valley," 2 vols.; Minot's "Land and Game Birds of New England;" Samuels' "Our Northern and Eastern Birds;" all the Reports on the Birds of the Pacific R. R. Survey, bound in 2 vols., morocco; and a complete set of the Reports of the Arkansas Geological Survey. Please give editions and dates in corresponding. R. ELLSWORTH CALL, High School, Des Moines, Iowa.

Wanted to buy or exchange a copy of Holbrook's North American Herpetology, by John Edwards. 5 vols. Philadelphia, 1842. G. BAUR, Clark University, Worcester, Mass.

For sale or exchange, LeConte, "Geology;" Quain, "Anatomy," 2 vols; Foster, "Physiology," Eng. edition; Shepard, Appleton, Elliott, and Stern, "Chemistry;" Jordan, "Manual of Vertebrates;" "International Scientists' Directory;" Vol. I. *Journal of Morphology;* Balfour, "Embryology," 2 vols.; Leidy, "Rhizopods;" *Science*, 18 vols., unbound. C. T. McCLINTOCK, Lexington, Ky.

For sale.—A 6½ x 8½ Camera; a very fine instrument; with lens, holders and tripod, all new; it cost over $40, price, $25. Edw. L. Hayes, 6 Athens street, Cambridge, Mass.

To exchange Wright's "Ice Age in North America" and Le Conte's "Elements of Geology" (Copyright 1882) for "Darwinism," by A. R. Wallace, "Origin of Species," by Darwin, "Descent of Man," by Darwin, "Man's Place in Nature," Huxley, "Mental Evolution in Animals," by Romanes, "Pre-Adamites," by Winchell. No books wanted except latest editions, and books in good condition. C. S. Brown, Jr., Vanderbilt University, Nashville, Tenn.

For Sale or Exchange for books a complete private chemical laboratory outfit. Includes large Becker balance (200g to 1-10mg), platinum dishes and crucibles, agate motors, glass-blowing apparatus, etc. For sale in part or whole. Also complete file of *Silliman's Journal*, 1862-1885 (62-71 bound); Smithsonian Reports, 1854-1883; U. S. Coast Survey, 1854-1869. Full particulars to enquirers. F. GARDINER, JR., Pomfret, Conn.

For exchange or sale at a sacrifice, an elaborate microscope outfit. Bullock stand; monocular objectives, one-sixth homogeneous immersion, four-tenths, and three inch, Bausch & Lomb, also one-fourth and one inch Spencer. Four eye-pieces. Objectives are the best made. Address Mrs. Marion Smith, 41 Branch Street, Lowell, Mass.

not sufficiently widely known to be called "Australian Men of Mark," and so the Chief-Justice decided against the enterprising publishers. Furthermore, the Chief-Justice ruled that all contracts entered into on account of the book, and not yet carried out, were null and void.

— Manganine is the name of a new alloy, consisting of copper, nickel, and manganese, which has been brought on the market, says the *Engineering and Mining Journal*, by the German firm, Abler, Haas, & Angerstein, as a material of great resisting power. The specific resistance of manganine is given as forty-two microhm centimetres; that is, higher than that of nickeline, which has hitherto passed as the best resisting metal. Another advantage of manganine is its behavior under variations of heat, the resistance, it is claimed, being affected only in a minute degree by high temperatures. It is therefore adapted for the manufacture of measuring instruments and electrical apparatus in general, which are required to vary their resistance as little as possible under different degrees of heat. A further interesting fact is that while other metals increase their resistance by the raising of the temperature, that of manganine is diminished.

— M. de Quatrefages, the well-known anthropologist, died on Tuesday, January 12. He was born, says *Nature*, in 1810, and studied medicine at Strasburg. Afterwards he became professor of zoology at Toulouse, where he had settled as a medical practitioner. In 1855 he was made professor of anthropology and ethnology at the Jardin de Plantes, Paris. He had already been admitted to the Academy of Sciences in 1852, and he was an honorary member of many foreign learned societies. Numerous friends and pupils were present at the funeral, and addresses were delivered by M. Milne-Edwards, and other men of science. The most famous of his writings are his "Crania Ethnica" and "Études des Races Humaines."

SCIENCE

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SCIENCE

NEW YORK, FEBRUARY 12, 1892.

ON THE TEACHING OF ANATOMY TO ADVANCED MEDICAL STUDENTS.[1]

THE importance of anatomy to the physician and surgeon has caused the method for teaching this science to be largely determined by practitioners. The student is taught the elements of histology, the shapes and numbers of organs, the outlines of regions, and their mutual relations. Other facts than those named belong in a very remote degree to the needs of practice; and when the great number of medical topics is considered, which is of necessity brought to the attention of the student, it is no wonder that governing bodies are disposed to disregard all phases of instruction that do not have direct claim upon the physician's time and service.

But science is rarely pursued for practical good. The acquisition of knowledge for its own sake — the determination of general principles that reveal the existence of law — awakens and maintains pleasures and interests in the mind of the anatomist compared with which the practical uses that he can make of the knowledge appear to be poor and mean. With as much propriety one might say that navigation is the highest use that can be made of the study of astronomy, as to assert that the chief end of the study of anatomy is to apply its tenets to medicine. These statements are made not to lessen the dignity and importance of practical work, but respectfully to claim that such work does not comprise all the value, indeed scarcely more than a small fraction of the value, that pertains to the whole.

In his "New Atlantis," Lord Bacon says: "We have three of our fellows that bend themselves, looking into the experiments of others, and cast about how to draw out of them things of use and practice for man's life, and knowledge, as well for works as for plain demonstration of causes, means of natural divinations, and the easy and clear discovery of the virtues and parts of the bodies. These we call dowry-men or benefactors. Lastly, we have three that raise the former discoveries by experiments into greater observations, axioms, and aphorisms. These we call the interpreters of nature."

I hear a response to the foregoing statement that the structure of animals exhibited on a broad scale is already taught to classes in the scientific schools, and that, in the scheme of a university education, the biological subjects are as well advanced as any others in the curriculum. This is an imperfect, if not misleading, presentation of the facts. It is true that the rudiments of the structure and functions of animals and plants are taught. But to students already advanced by general training and by preliminary work in natural history, little is presented that prepares them to discuss the more intricate problems.

To my mind the scheme of university work is unsatisfactory until opportunity is afforded to men, who, after completing their biological and medical training, may desire to still further advance. Conceding that the question of maintenance has been settled, either by the possession of private means or by endowment of fellowships, what courses of instruction are afforded these advanced men? As a rule, nothing, or next to nothing. It is customary for such novitiates to reside abroad for several years, where, amid numerous centres of learning are found one or more masters, the disciples of whom they become. The advantages of travel being considered, it may be said that with the comparatively easy means of obtaining the best instruction the present scheme is on the whole adequate. With such a conclusion I cannot agree. If it were true, we might in reason have stopped long ago in our lines of university expansion. Independence in intellectual as well as in political life should be the object of American citizenship.

First, and always, let us remember that medical investigators are those it is desired to train. It is for men that are already imbued with the desire to pursue their researches in anatomy that I appeal. They stand in this field with what preparations can be given them for usefulness. They are medical biologists — medical anatomists. They are not restricted to the problem of the relief of suffering, and yet they are occupied with those other problems upon which the true solution of all depends.

For such instruction I would have a specially-designed museum and a specially-equipped laboratory. It may be assumed that in every great medical school, from among the large number of matriculates (men already trained and of the best quality), two or three of the type described will present themselves for an advanced course in anatomy. I am prepared for the objection that this is too large a number. But, so far as I know, no one has attempted to ascertain how many men in each class of graduates would come forward, and my impressions are based upon the number of workers in the general field of biology — some of whom, at least, would have pursued these or similar studies had any systematized course been presented to them. I will, therefore, begin with three men a year. To this number may be added as many young teachers, tutors, curators, and prosectors, who would avail themselves of the instruction. The work might be initiated in either of the halls of biology or of medicine. If the course were well established, it would be well to institute a laboratory and museum distinct from any on the university grounds. I am of the opinion that the administrative success of such separation of collections would be assured. All must approve of the ethnological collection of Harvard being distinct from the Museum of Comparative Zoology, and of both in turn being set apart from the museum in the Medical School. In like manner, I assume that there is no reason why series of specimens arranged in illustration of principles that are not taught either in the preliminary or in the proper medical courses, should be necessarily connected with one or the other museum. The collections should be in the main designed to accommodate the preparations that are used in the illustration of general lectures. Museums that teach by the specimens being removed from the cases to the lecture halls are radically distinct from museums that teach by the conservation of series that are

[1] Also published in The Medical News, December 26, 1891.

arranged and labelled for instruction as they stand, and which should be rarely, if ever, disturbed.

The following, treated in some detail, embrace the topics that occur to me at this time as appropriate subjects for instruction: The study of the human brain; especially the study of the mammalian and avian brains, both of the gross and the minute anatomy, the localization of functions, etc. The study of muscular anomalies and their homologies in the normal myology of the vertebrates. The study of animal locomotion and its application to the morphology of the vertebrate limb, and in general the application of photographic methods in studying animal locomotion.[1] Studies in craniology, especially the comparative studies of human and mammalian crania. The study of osteological variations, with a similar application to the normal anatomy of the lower animals and the beginning of morbid processes. The study of nutritive processes on tissue as correlated to age.[2]

In addition, courses of experimental morphology might be essayed. Such investigation could be encouraged without encroaching on the domain of physiology, as the votaries of this science somewhat arbitrarily restrict it. Indeed, much of the study of animal locomotion would be experimental, as would also be the study of protoplasm in viscid media, under rotation, compression, etc. The effects of light, temperature, water in motion and at rest, etc., on organization, would naturally find a place. Experiments on mutilation of embryos might also be undertaken.

Lectures on correlation of structure, on vegetative repetition, on the relation existing between phyllogenetic and teratological processes, could be given, as well as the study of the laws of heredity, especially in attempting to answer the question of the transmittal of acquired characters.

The teeth are so responsive to the constitutional peculiarities of the individual that their peculiarities can be seen and readily detected. The method of procuring accurate impressions can be applied, and the plans of preserving the form of teeth be easily accomplished.

As is known to the zoologist, the parts involved in the act of mastication are important in the classification of the mammalia, the slightest departure in the form, number, position, and rate of development of the teeth being for the most part correlated with other variations in the economy, while the shapes of the lower jaw and of those portions of the skull that afford surfaces for attachment of the masticatory muscles are of importance. No structures of the body resemble the teeth in the character of their response to morbid impressions; no other organs are arranged in progressive series; and none other than these are evolved after birth. Hence the effects of disease and accidents to which the teeth are subjected are sure to be recorded in the shapes of the crowns and roots.

If the student of heredity were to have placed at his disposal a collection of the casts of the permanent teeth of three generations — that is to say, of the parent of the subject, the subject himself, and the children of the subject — and if a clinical history were secured of the diseases and accidents that these persons had incurred, a tenable argument might be established as to the significance of the contrasts or resemblances in the forms of the teeth.

Thus, if three generations were expressed by the letters A, B, C, and if B is the subject of an acquired character (let us say from scarlet fever or measles), the new form of structure seen in the second and third molars may be transmitted to C. But in order to prove this it is necessary to know the peculiarities of these teeth in A. Hence, the teeth of the ancestors and descendants of the person who exhibits the acquired character must be known. A somewhat similar plan of observation could be made on the teeth of the lower animals. It is strange that those teeth with endless pulps, in which growth is rapid and interference with their relations causes permanent records to be made in malformation, should not have been used in studies of nutrition.

In connection with myological studies a number of minor problems suggest themselves; such, for example, is the nature of white and red muscles. It has been noted that in ostriches that have been confined in zoological gardens the muscles of the leg undergo fatty degeneration and become white in color; it is also known that the pectoral muscle in many of the gallinæ is white, presumably from the fact that they are used but for short and infrequent flights. How evident is the conclusion that a systematic study of all muscles of active birds living in enforced confinement, as compared with the relatively active muscles in feral forms, might be undertaken with a fair prospect of throwing light upon the nature of the process, and with a hope that the subject of fatty degeneration (even if by this method not elucidated) may have its study placed on a broad basis by subjecting its tenets to the tests of systematized experiment and observation!

The morphological study of the results of diseased action might also be undertaken. The differences that obtain between normal individuals and those the subjects of hereditary disease must be of importance to the anatomist and the pathologist.

The variations in the forms of the bones, as found in medical museums, are of a character that suggest their relation to inherited causes. Every clinical observer has noted the peculiar shape of the chest in families in which pulmonary phthisis is hereditary, even though the special tuberculous deposits are absent in some of its members. The clubbling of the finger-nails is a sign of the same disposition. Some writers, indeed, claim that in this class of subjects a special arrangement of the fibres of the pneumogastric nerve exists. Are these and similar morphological characters susceptible of being also gathered so as to contribute to the discussion of the transmission of acquired characters? Are not opportunities here presented for the medically trained biologist to study the subject of heredity in a line so important and, alas! with material so abundant? Other hereditary diseases, such as struma, syphilis, and gout, are less strongly marked than is the tuberculous, but even on this obscure horizon landmarks are detected that are of sufficient definiteness to guide the observer to well-defined plans of study. The animals of zoological gardens exhibit examples of acquired struma, the effects of which more especially distinguish the skeleton. Can any of these characteristics be transmitted? How would the skeleton of a tiger, let us say, born in captivity in the third and forth generation differ

[1] Instantaneous photographs have given us definite conceptions of the behavior of the manus and pes in terrestrial and aerial movements. I had the honor to point out as a result of a study of the negatives taken by Mr. E Muybridge under the auspices of the University of Pennsylvania, that the ground is touched by the outer border of the foot and is left by the inner border, and that the impact represented by this transition is expressed by an oblique line that extends from without inward (ecto-entad) across the metapodium. Professor H. F. Osborne, by studying the carpus and tarsus in extinct forms of mammalian life, has found that this conclusion is of value in studying the evolution of the parts. From this we can conclude that, as a result of a photographic plant in connection with advanced anatomical work, discoveries could with some confidence be anticipated.

[2] This would form a morphological study on the nature of age; and would more particularly embrace a consideration of the immature and senile forms as compared with the typically adult, as well as the retention of juvenile characters in the adult.

from that of a feral type? After what manner may one expect taxonomic characters modified in these generations of prisoners?

The nature of malignant growths, it is not improbable, would find a solution in a line of research based upon a similar proposition. What proportions of malignant growths, such as the sarcomata, are met with in the feral state of quadrupeds as compared with those in the domesticated or the captive state? Can experiments be devised by which we may expect to cause these growths to appear by creating the favoring conditions? Can we study the genesis of the sarcomata to better advantage than has hitherto been done, by outlining the biography, the lineage, and to some extent possibly the destiny, of these tumors, by applying to them experimental methods of research?

Medically trained men are not apt to become pure morphologists. The underlying thought is of *function* through which *structure* is modified. In its best sense, therefore, physiological anatomy is the branch of science that would be most developed. Let us suppose that John Hunter had lived in 1891 and had essayed his work by all the aids of modern science, and had undertaken a plan of investigation for the continuation of his labors: might he not have accepted some such scheme as I have feebly attempted to portray? With the admiration we feel for his genius, let us not only have Hunterian orations, but in each medical centre a Hunterian laboratory and a Hunterian museum.

"I am so utterly opposed to those cloud-builders who would divorce physiology from anatomy," says Haller, "that I am persuaded that we know scarcely anything of physiology that is not learned through anatomy" (quoted from R. Cresson Stiles's "Life and Doctrines of Haller," New York, 1867).

In Solomon's house, in the "New Atlantis," in which Bacan essayed a scheme for intellectual advancement, we read of "parks and enclosures of all sorts of beasts and birds, which we use not only for view or rareness, but likewise for dissection and trials, that thereby we may take light what may be wrought upon the body of man; we have also particular pools where we make trials upon fishes, as we have said before of beasts and birds."

I hear objections that this scheme is visionary and impracticable. How is the money to be obtained by which it can be rendered feasible? Where is the teaching-force to be recruited? My answer is that if the need of establishing such a course be acknowledged, the accomplishment of the end in view is no more difficult than in any other branch of pure science. A few years ago the establishment of seaside laboratories would have beeu thought chimerical. Now they are assured successes.

If I am told the results obtained will appeal to but few, I reply that important projects must be supported in proportion as they so appeal, until such time as they shall have proved their right to exist.

HARRISON ALLEN.

TIME-SERVICE OF HARVARD COLLEGE OBSERVATORY.

THE time-service of this observatory has been maintained for nearly twenty years upon the system originated by the late Professor Joseph Winlock. Continuous signals, that is, signals throughout the entire twenty-four hours instead of for a short time each day have been furnished to the cities of Boston and Cambridge, and have been used to strike the bells of the fire-alarm daily at noon. For many years a time-ball has been dropped, thus furnishing a precise time-signal to many citizens and to the shipping in the harbor. The continuous signals have been sent also to the railroads centring in Boston, and to the Boston office of the Western Union Telegraph Company, and have been distributed by them over a large part of New England. Many cities and corporations, although not subscribing for the time-signals, have been in the habit of taking them from the railway and telegraph stations, thus extending their use. The time-service in New York City was thus supplied with our signals for many years. The signals, again, have been furnished to the principal jewellers in Boston and vicinity, and used by them in the rating of fine watches. The lines transmitting the time-signals in these various directions affected the telephone lines by induction and otherwise, and thus many other persons obtained the signals by merely listening at the telephone.

The subscriptions of the city of Boston and of the railroads, and the receipts from the jewellers were sufficient to defray the cost of furnishing the exact time, and for some years formed a source of revenue to the observatory. No charge was made to the city of Cambridge or to the Western Union Telegraph Company. The expenses were, however, large, since it was necessary to duplicate the instruments and clocks employed, although the cost of the necessary duplication of the lines connecting the observatory with Boston was diminished by the arrangement with the Western Union Telegraph Company. For several years, also, the city of Cambridge rendered similar assistance. Although the best clocks were used and mounted in vaults specially constructed so as to secure a uniform temperature, great care was necessary to keep not only the errors, but also the changes in daily rate, as small as possible. It was necessary to compare the clocks frequently, and to determine their errors by observations of the stars at short intervals. Especially after several days of cloudy weather, the first opportunity was taken to secure observations, although this often occurred at inconvenient hours. Frequent interruptions took place on the lines, and it was therefore necessary constantly to have men ready to detect and repair breaks, crosses, and other injuries.

The general introduction of standard time was considered at the observatory some months before this step was taken. Since the same signals could be used throughout the entire country, it was recognized as a source of danger pecuniarily to the time-service. This argument, however, was allowed to have no weight, since it was believed that the change would be a benefit to the public. As it happened, this observatory was enabled to take an active part in making the change, since all of the railroads centring in Boston assented only on condition that our signals should be sent according to the new system. When the change had been decided upon, various steps were taken by the officers of the observatory to secure the general and simultaneous adoption of the new time by the country.

A new source of difficulty and danger in distributing time-signals has arisen during the last few years. The great increase in the number of telephone and other wires has rendered it much more difficult to maintain an unobstructed circuit. Breaks and crosses are continually occurring, especially in stormy weather; and the privilege of placing wires on housetops is every year less willingly granted. Recently a more serious danger has arisen. The currents of high tension carried by electric-light and electric-railway wires, in case of a cross, may be transmitted indefinitely, causing danger of fire, bodily injury, or even loss of life. Pecuniary liabilities in such cases may be very great. The financial officers of the university regard such risks as more than offsetting the receipts for the time-signals.

One of the greatest advantages of the time-service to the observatory has been that it kept before the public the practical value of astronomical work. Many thousands of persons who take no interest in work of a purely scientific character recognize the great financial value to the public of an accurate system of time. The observatory desires to confer this benefit on the public, and it would be ready to do so even at a financial loss. But recently the time-signals of the United States Naval Observatory have been offered to the public at very low rates, through the Western Union Telegraph Company. This can the more readily be done since the expense of furnishing the time is borne by the people through a government appropriation, while the company has the largest facilities for the maintenance of telegraphic connections. The Harvard College Observatory is therefore relieved of this duty. If the public is to be the gainer, signals of equal accuracy and continuity must be furnished. Unfortunately, signals sent to a great distance are liable to frequent interruptions from trouble with the telegraph lines, and therefore secondary clocks must be used in each large city if continuous signals are to be distributed. These clocks must be constantly compared and corrected if great accuracy is to be attained, and it is still a question whether satisfactory results can be secured outside of an astronomical observatory. If the results prove unsatisfactory, however, the responsibility for trying the experiment will not rest upon this observatory.

In view of the facts stated above, it has been decided to discontinue the time-signals furnished by this Observatory after March 31, 1892. An earlier date would have been selected, but for the desire to give our subscribers sufficient time to make other arrangements for securing signals.

The most important events in the history of the time-service are given below. The first transmission of time from the observatory to Boston was over a line hired for the purpose and used occasionally for the comparison of clocks in Boston with the standard clock at Cambridge. From 1856 to 1862 the observatory owned a line for the same purpose. Up to the close of 1871, no charge was made for the time thus furnished, which was used for many years for striking the fire-alarm bells of Boston at noon, and for other purposes. The regular transmission of signals and the receipt of compensation for them began in 1872, the service being under the direct care of Professor Winlock, who had devised the system. After his death in 1875, Professor W. A. Rogers took charge of the service and introduced the custom of telegraphing information as to the error of the signals at a given hour daily. In 1877 Dr. Leonard Waldo took charge, and during the next year, with the liberal co-operation of the Equitable Life Assurance Company, the Boston Time-Ball was erected on top of the building of that company. In 1878, also, a correspondence was opened with the railways of New England relative to a uniform system of time and the practicability of introducing it by legislation. A plan for establishing a bureau for the testing of fine watches and thermometers was considered, and abandoned on the ground that such work would be commercial rather than scientific, and therefore not within the scope of the observatory. In 1879, Professor Frank Waldo, who had previously assisted his brother, took charge of the time-service. The error of the standard sidereal clock was determined every day at 10 A.M. from the latest comparisons with the stars, assuming the rate to continue uniform. The mean-time clock was compared with this, and for several years the difference had been communicated every day by telegraph. This practice was abandoned, since it was easy to reduce this difference to zero, and it did not indicate the true error of the clock. Especially during continued cloudy weather, large changes might take place in the rate of the sidereal clock, which could not be determined until observations could be made of the stars. At this time the signals were sent to New York, and were used in the time-service of that city in combination with similar signals sent from the Naval Observatory and Allegheny Observatory. It developed the interesting fact that the differences, sometimes amounting to several seconds, were much greater than were expected, or than would be derived from combining the supposed errors of the different time-services. This was regarded as a preliminary trial of a plan which was developed later, and appears to be the only way of effecting a great increase in the accuracy of time-signals. It is easy to keep the errors of a clock small if the weather is clear, and frequent comparisons can be made with the stars. During long periods of cloudy weather, however, when no observations of the stars can be made, it is very difficult. The slight changes of rate to which even the best clocks are liable may cause serious errors at the end of several days. The remedy is co-operation between observatories so distant that it would seldom happen that clouds would prevent observations at all of them. The time would be determined at each observatory every evening, when it was possible, and the result transmitted telegraphically to a central station; also when called for, as soon as it cleared, whatever the hour. The central station would report daily to each observatory either the results of each observation received or a corrected error derived from them all. Each observatory might send its own time or receive signals from a normal clock at the central station. Mr. J. Rayner Edmands, who has had charge of the time-service from June, 1881, to the present time, rendered important aid in forming this plan. He postponed the record of the errors occurring during cloudy weather until observations could be made for determining them. The apparent errors were thus increased, but the actual errors were represented with much greater accuracy. The practice of making the error at 10 A.M. especially small was abandoned, and attention was given to keeping the signals as accurate, and the daily rate as small as possible at all hours. The general introduction of standard time was effected at noon on Nov. 18, 1883. After the change was decided upon, a large part of Mr. Edmands's time for several weeks was devoted to securing the assent of the public throughout New England to the proposed change. In 1885, a new time-ball was erected on the Boston post-office building, with the aid of an appropriation from the city of Boston. Experiments were made in various matters associated with the distribution of accurate time. Among others, a delaying apparatus was devised, by which the signals of a clock could be retarded by any desired fraction of a second, so that, without disturbing a clock, its apparent error could be varied at will. In 1889 some interesting experiments were made by Mr. W. P. Gerrish on distributing time accurately by flashes of magnesium powder. Signals were thus sent from a station on Blue Hill, twelve miles distant. They were readily visible, and the exact time to within a fraction of a second could be taken from them. These flashes were also seen from Princeton and Mount Wachusett, forty-four miles distant, and from numerous nearer points. From an early period in the life of the time-service, the telegraphic lines have been in charge of the electricians, Messrs. Stearns and George, and their successor, Mr. C. L. Bly.

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NOTES AND NEWS.

MR. J. L. KIPLING says of the monkeys of India: "They have a game like the English boys' cock of the dung-hill or king of the castle, but instead of pushing each other from the top of a knoll or dust-heap, the castle is a pendant branch of a tree. The game is to keep a place on the bough, which swings with their weight as with a cluster of fruit, while the players struggle to dislodge one another, each, as he drops, running round and climbing up again to begin anew. This sport is kept up for an hour at a time with keen enjoyment, and when one is nimble as a monkey it must be splendid fun."

— In 1890 was published the important discovery by Behring and Kitasato that blood serum taken from animals that had been rendered immune to tetanus and diphtheria was capable of curing other animals suffering from those diseases. Drs. G. and F. Klemperer (*Berliner klinische Wochenschrift*, Aug. 24 and 31, 1891) publish a research carried out in regard to pneumonia, with the object of discovering how immunity against the pneumococcus could be best produced, whether recovery from the disease rendered an animal immune, and whether it was possible to cure pneumonia by the blood serum of animals that have recovered from the disease. Their experiments, which were confined to rabbits, revealed that every nutrient medium in which the pneumococcus has been cultivated will, if inoculated, render an animal immune against pneumonic septicæmia, even after the cocci have been removed by filtration. The power of producing immunity is more speedily acquired, and is increased if the infected nutrient medium (before or after removal of the cocci) is exposed to a temperature of between 41° and 42° C. for two or three days, or of 60° for an hour or two. In every case, however, it was found necessary that some interval (varying from three to fourteen days) should elapse between the inoculation and the production of immunity. Hence it was too late to cure a diseased animal or even to prevent the onset of an attack if the injection was given simultaneously with the outbreak of the disease. On the other hand, serum taken from animals enjoying immunity was found able, especially when introduced directly into the circulation, to cure pneumonic septicæmia. The serum was injected twenty-four hours after infection, while the animals had a febrile temperature of between 105° and 106.5° F. Eight cubic centimetres were injected, with the result that the temperature gradually sank during the next twenty-four hours. In twelve successive cases a successful result was obtained. This research therefore confirms, in regard to pneumonia in rabbits, what Behring and Kitasato did for tetanus and diphtheria Drs. Klemperer next studied the question how the blood serum of an immune animal cures an attack of pneumonic septicæmia, and discovered that when the pneumococcus is introduced into the body of an animal it generates a poisonous substance which can be isolated, and to which the name of "pneumotoxin" has been given. This pneumotoxin sets up a febrile condition which lasts several days, after which another substance is found to have been produced called "antipneumotoxin," which is able to neutralize the pneumotoxin. The serum taken from an immune animal contains this antipneumotoxin, and it is by means of this substance that it cures an attack of pneumonic septicæmia in other animals. The relation of pneumonia as seen in rabbits with that met with in man was next investigated, and the conclusion arrived at that the disease in both cases is produced by the pneumococcus, but that the human body is much less susceptible to the latter than the rabbit is. Thus it was found that serum taken from pneumonic patients after the crisis could cure pneumonia in rabbits; moreover, pneumotoxin and antipneumotoxin were found to be present in human serum as in that taken from rabbits. The crisis of pneumonia, according to Drs. Klemperer, takes place as soon a antipneumotoxin is produced in sufficient quantity to neutralize the pneumotoxin. Why immunity against further attacks lasts so short a time in man is still uncertain, but possibly less antipneumotoxin is formed in man than in rabbits in proportion to the pneumotoxin. Some attempts have already been made to cure patients suffering from pneumonia with the help of antipneumotoxin, but further observations are necessary.

— It is a well-known fact that, with the same temperature by the thermometer, one may have, at different times, a very different feeling of heat and cold. This varies with the temperature of the skin, which is chiefly influenced (according to M. Vincent of Uccle Observatory, Belgium), by four things: air-temperature, air-moisture, solar radiation, and force of wind. M. Vincent recently made a large number of observations of skin-temperature in the ball of the left hand, and constructed a formula by means of which the skin-temperature may be approximately deduced from those four elements. He experimented by keeping three of the four constant, while the fourth was varied, and a relation could thus be determined between the latter and skin-temperature. One fact which soon appeared was, that the relative moisture of the air has but little influence on skin-temperature. It was also found that for every 1° C. of the actinometric difference (excess of black bulb thermometer) the skin-temperature rises about 0.2°; and with small wind-velocities, every metre per second depresses the skin-temperature about 1.2°. In testing his formula M Vincent found, with cold or very cold sensation, considerably greater differences between the calculated and observed values than in other cases. This he attributes to the great cooling of the relatively small mass of the hand. Taking the cheek or eyelid the results were better, says *Nature*.

— Last winter, in December and January, M. Chaix made a number of observations of the temperature of the air, the snow, and the ground at Geneva, of which he has given an account to the Physical Society there. He observed the air at four different heights; granular, pulverulent, and bedded snow, on the surface and at different depths; and the surface of bare ground as well as of ground covered with snow. There was no difference in mean temperature between the air at one and two metres; and very little between the former and that on the snow surface. The surface of the ground was 4.265° C. warmer than the surface of the snow (0.13 m. above), through arrest of radiation. But the bare ground was not cooled so much as the snow surface, and it was only 2 04° colder than the snow-clad ground. This shows the frigorific influence of snow on climate. Air passing over bare ground would have been 2° warmer than if it passed over the snow. The snow surface was sometimes warmer, sometimes colder than the air one or two metres above. In the dry winters of Siberia and Sweden, the snow-surface is generally (according to Woeikof) much colder than the air. M. Chaix explains the variations observed at Geneva by fluctuations in the relative humidity, involving alternate vaporization and condensation at the snow-surface. In two-thirds of the cases, indeed, abnormal cooling of the snow corresponded with a low humidity, and heating with a high humidity, and often formation of hoar frost at the surface, according to *Nature*.

— An illustration of the height of breaking waves is afforded by the following paragraph, which we take from the San Francisco *Chronicle* of Jan. 6: "Portland, Jan. 5 The lighthouse tender 'Manzanita' reached Tillamook Rock Sunday for the first time in six weeks, and brought away the keeper, George Hunt, who has been on the rock for four years, and has been transferred to the Cape Mars Light. He says, in the storm of Dec. 7 the waves swept clear over the house, washing away their boats, and tearing loose and carrying away the landing platform and tramway, which were bolted to the rock. On the 29th the waves were still higher, and streams of water poured into the lantern through the ventilators in the balloon top of the dome, 157 feet above the sea-level. The lighthouse was shaken to its foundation by the impact of seas against it, and the water found its way into the house. Men were on duty all night to keep the lamp burning, and but for the wire screen the shutters of the lantern would have been demolished."

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LATEST DETAILS CONCERNING THE GERMS OF INFLUENZA.

DR. R. PFEIFFER, overseer of the scientific division of the Institute for Infectious Diseases at Berlin, has the credit of discovering, isolating, describing, and inoculating the germs that are the cause of influenza. The following results are based upon his thorough investigation of thirty-one cases of influenza, in six of which autopsies were made.

1. In all cases there was in the characteristic, purulent, bronchial secretion a definite kind of bacillus. These rods were shown in uncomplicated cases of influenza, in an absolutely pure culture, and for the most part in large numbers. Very frequently they lay in the protoplasma of the pus-cells. Where the patient has been subject to other bronchial troubles, one finds in the sputum, in addition to the influenza bacilli, other micro-organisms. The bacilli can enter from the bronchi into the peri-bronchial tissue, even to the surface of the pleura, where in purulent coats in two autopsies they were found in pure culture.

2. These rods were found only in influenza. Numerous control-experiments showed their absence in common bronchial catarrh, pneumonia, and phthisis.

3. The condition of the bacilli varied with equal force in the course of the disease; first with the exhaustion of the purulent bronchial secretion the bacilli also disappeared.

4. Two years ago, at the first appearance of the influenza, I saw and photographed the same bacilli in large numbers in preparations of sputum from influenza patients.

5. The influenza bacilli appear as small rods, of about the thickness of septicæmia bacilli in mice, but one-half their length; frequently three or four bacilli are found arranged one after the other like in a chain; it is difficult to stain them with the basic aniline dyes; one obtains better preparations with Ziel's solution and with the hot methyline blue of Löffler. In this way one sees almost regularly that the end-poles of the bacilli stain more intensively, so that forms arise which might be very easily mistaken for diplococci or streptococci. The bacilli are not stained by Gram's coloring matter; and in hanging drops they are immovable.

6. These bacilli can be obtained in pure cultures; in one and a half per cent sugar-agar the colonies appear the smallest. The continued culture in this nutrient medium is difficult, and I have not been able to go beyond the second generation.

7. Many experiments for transmission to apes, rabbits, guinea-pigs, rats, pigeons, and mice were made. Positive results could be obtained only in apes and rabbits. The other species of animals were refractory to the influenza.

8. These results justify the conclusion that the above described bacilli are the cause of influenza.

9. Infection comes very probably from the germs of the disease in the sputum; and therefore for prevention of contagion the sputum of influenza patients must be made innocuous.

Dr. Kitasato has succeeded in cultivating the bacilli of influenza to the fifth generation upon glycerine-agar.

ARTHUR MACDONALD.

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A SERIES OF ABNORMAL AILANTHUS LEAFLETS.

A STURDY trumpet creeper (*Tecoma radicans*) has entwined itself about an ailanthus tree which stands in our yard, near the veranda. Together, they form quite a charming bower during the summer time, when the bright trumpet flowers are so profusely intermingled with the dark green foliage of vine and tree.

It was here that I had taken my chair one afternoon, to enjoy an hour's undisturbed reading. My anticipations of quiet, however, were very soon interrupted, by a sudden gust of wind, which set the leaves of my book a-fluttering so, that I was obliged to close it. But "it is an ill wind that blows nobody good," I said to myself, as I stooped to pick up some leaflets which came fluttering down from the ailanthus tree.

Although it was only June, these leaflets were of a bright yellow color, like the tints of early autumn. But what attracted my attention especially was their variation from the typical form. Every leaflet had a peculiar notch, lobe, or lop-sided outline which would cause it to be classed among monstrosities, or abnormal leaves. These abnormal specimens were more to me, however, than mere "freaks of nature." They were the tablets on which their own history was inscribed.

If we take one of the large ailanthus leaves, with its long rachis and numerous leaflets, we are led to inquire into the manner of its numerical increase of leaflets. At a cursory glance at the leaves we find that although the vast majority are odd-pinnate, there are many which we are scarcely justified in calling odd, nor yet should we denominate them even pinnate. That is, transition stages between odd and even pinnate quite commonly occur, and I would call these "abnormal leaves" transition stages. They are the keys which will unlock for us the mystery of their development. Let us see if such is not the case: let us make use of these keys and thereby learn whether such is not the verdict rendered by the leaves themselves. We will put our queries to the terminal leaflets, because they seem to be the centre of evolutionary activity in nearly all pinnate leaves.

We have quite an advanced transition stage in Fig. 1 of our series; it has quite a conspicuous projection beyond the typical outline on the left side; a prominent vein is seen extending to the apex of this abnormal projection, from which on the lower side, lead smaller, well-marked veins. There is also a very slight point on the opposite side of the leaflet, the venation here being similar to that just described What, then, does this abnormal leaflet mean? Can we not see that nature has decreed that there shall be an increase in the number of leaflets? And that she is about to "cut off" new leaflets from each side of this terminal leaflet?

Fig. 2 confirms us in this supposition, and furnishes an objective demonstratian of a more advanced transition stage. The sinuses have deepened, and the two lobes bid fair to become separate individual leaflets. We feel secure in making this statement because Fig. 3 stands ready to make good our word with a newly-added leaflet on one side and another on the other side, well under way. The rachis, meanwhile, has elongated to make room for the new-comer. Fig. 4 illustrates a repetition of this process of division, adding emphasis to our explanation of these "abnormal leaves." Nature is going right on, bent upon working out her conceptions to the fullest extent.

Nos. 5, 6, and 7 are certainly extremists. They may, perhaps, be compared with the impulsive, rampant reformers in the social world, who are imbued with a stronger progressive impulse than will harmonize with existing conditions; whose wishes to surmount all obstacles and soar aloft lead judgment and reason astray. The time is not ripe for

LEAFLETS FROM THE AILANTHUS TREE.

such prodigious strides, and much effort is therefore expended to little purpose. A few such leaders will occasionally be found among plants, fore-runners, as it were, of future attainment, and here we have leaflets which as yet have not even attained to an individuality of their own, taking upon themselves the work which legitimately belongs to the senior members of the family; if we may designate a leaf as a little family, and the leaflets thereof the individual members. No. 8 is such a senior member; that is, instead of a terminal leaflet it is from the base of the leaf. It is better able to take up the burden of secondary division than the mere baby leaflets that have not yet learned to take care of themselves. No. 8, however, may also be classed with the reformers, but with that more reasonable class who are not entirely beyond the ken of normal vision.

Would we not, therefore, be led to draw this conclusion from what we have said (and, I trust, demonstrated), that pinnate leaves are developed by a division of the terminal leaflet: the bi-pinnate leaf is evolved from the pinnate by the division of the leaflets, normally beginning in the lower or basal leaflets? That this is the law of division which holds among the majority of pinnate leaves is quite commonly demonstrated and verified by the leaves of various plants. The leaves of the trumpet creeper furnish as good illustra tions of these various stages of transition as the ailanthus leaves.

There is but a slight point on the lower or outer portion of the typical basal leaflet of the ailanthus; this point is crowned with a small gland; here seems to be the starting-point of the new departure, which, according to the prediction of No. 8, will, in the course of time, result in the evolution of a bi-pinnate ailanthus leaf. This secondary division, as we have chosen to call the division of the lower leaflets, is illustrated abundantly by the common elder (*Sambucus canadensis*). So conspicuous, indeed, are the variations in the elder that it deserves a chapter on its own progressive efforts; it seems especially able to respond to favorable conditions. MRS. W. A. KELLERMAN.

Columbus, Ohio.

SUGGESTIONS AS TO TEACHING BOTANY IN HIGH SCHOOLS.

THE teaching of botany in our colleges and higher schools during the last twenty-five years has had the unfortunate effect of bringing the science into disrepute, and of engendering in the minds of many who — as they would say — "took" it (like a dose of medicine), a thorough distaste for it. It is only within ten years that any radical change has taken place in the teaching ideals, and even to-day in many of the best institutions of learning, conservatism forces instruction into the old channels. The lower schools have travelled the same line, partly because they knew no better way, and partly because they were meeting the demands of the higher schools in the matter of preparation.

The radical defect of the older teaching lay in the failure to study the plants themselves; in the failure to treat them as living organisms; and in the failure to take into account the existence of other plants than the flowering ones. The ease with which plants could be collected and preserved by drying early led to the study of their external characters with a view to their classification alone. From the earliest times, therefore, almost to the present day, classification has been looked upon as the most important portion of the science of botany. Now, however, that the economic importance of the study of the physiology of healthy and diseased plants and of the causes of disease is coming to be more generally appreciated, it is high time that both in primary and secondary schools those portions of the science be taught which have a vital and vitalizing interest.

What Text-Book Shall We Use?

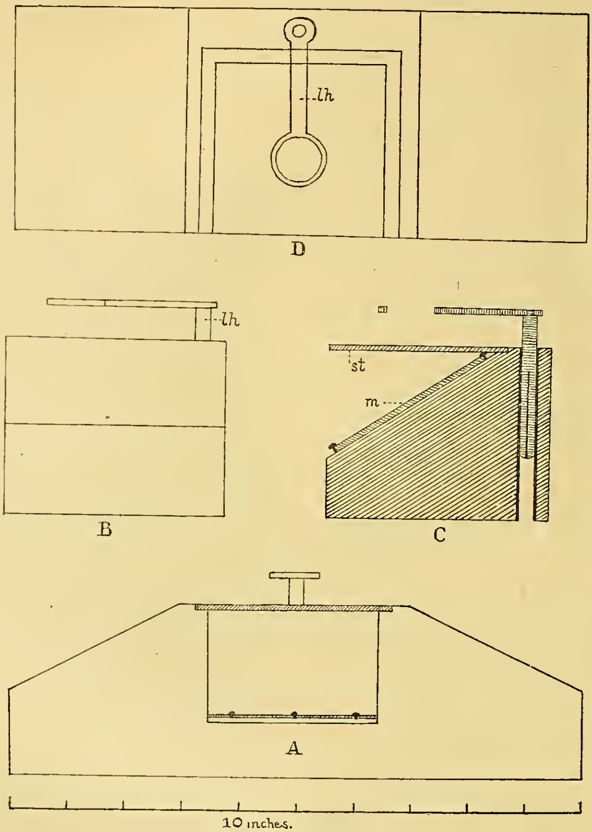
The first question that is usually asked is, "What text-book shall we use?" It is a difficult question to answer, and probably the best reply is, "Whatever text-book the teacher can use best." There is no book known to me which presents the subject in just the way that I consider most important. Probably the one of most general adaptability is "Gray's Lessons in Botany." If the teacher is capable of using them, either Bessey's "Essentials of Botany" or Campbell's "Structural and Systematic Botany" may be recommended. Wood's "Lessons in Botany," revised, is unfit for use on account of the numerous and misleading blunders which it contains. There should be in the school library, for reference, Gray's "Structural and Systematic Botany," Goodale's "Physiological Botany," Bessey's "Botany," and Goebel's "Outlines of Classification." Miss Newell's "Outline Lessons in Botany" will be found suggestive to the teacher who knows nothing of the method of study suggested herein.

The suggestions here made are based on the supposition that the scheme of studies proposed by the State superintendent is accepted, in which two terms are assigned to botany, beginning in the winter term. It is also presupposed that the School Board will be willing to supply the pupils with a proper room and a small amount of apparatus. I consider the providing of these quite as indispensable for the study of botany as furnishing a recitation room for mathematics with a blackboard and its accessories.

The room should be furnished with a sufficient number of common kitchen tables (those with unfinished tops are best), at which two students can work comfortably, and even four if crowded. The more windows the better.

The apparatus required is simple. Simple lenses with some device for supporting them while the hands are used in dissecting are needed The figures annexed show a most effective and low-priced dissecting stand which is in use in the University of Wisconsin and is to be preferred to more expensive ones. The block can be made by a carpenter for a few cents; the plain and mirror glass can be procured at the glazier's; the lenses and lens holders can be procured from the Bausch & Lomb Optical Co., Rochester, N.Y. The total cost should not exceed $1.75 If preferred, they may be procured of Mr. L. S. Cheney, Madison, Wis., at $1.75 for single stands, with a discount of ten per cent on orders for ten or more.

A deep individual butter dish is necessary for examining specimens in water. Each student should have a pair of needles (No. 6, "sharps") with the eye-end driven into soft pine handles. This can be done by holding the needle with a pair of pliers and forcing it in. The pupil should be required to provide himself with a sharp bladed pen-knife, a rarer article than might be supposed.



DISSECTING MICROSCOPE.

The body is a solid block of clear pine, cut as shown in *A*, front view; *B*, end view; *C*, median cross section; *D*, top view. *lh*, lens holder, which slides in brass tube driven into a hole in block (sec. *C*.); *st*, stage, a movable glass plate; *m*, mirror, fastened with small screws or tacks.

How to Get Material.

I should begin with a study of the flowering plants. There will be room for the exercise of some ingenuity in getting pupils to provide proper material for study by raising some and collecting some. Lima beans, sunflowers, and corn can be grown in pots or boxes; window gardens, greenhouses, and provision stores can be levied on until the spring opens. But it is better to have material collected in the summer and preserved in alcohol. Such material should be studied in water to prevent drying and to remove brittleness.

How to Begin.

It matters little what part is selected for a beginning. As the study commences in winter, the shoots of trees, two or more feet long, may be used. Select a tree in which the scars left by the fall of the foliage, leaves, and bud scales of the preceding season are quite conspicuous, such as the cottonwood, poplar, hickory, or horse-chestnut. Set the students at work to examine these before they have been assigned any study in the book. Have them examine all the markings they can find; compare the buds; study the relation between the buds and the scars; determine the extent of the preceding season's growth and of the season before that. When as much of the external anatomy has been seen as possible, let them carefully dissect the buds, studying the nature and shape of the scales; the character of their surfaces, whether hairy or resinous; the young foliage leaves for the next season; the young stem, comparing the shoot for the coming season with last season's growth, noting differences and resemblances. This dissection should be made partly by tearing off the parts, partly by cutting thin slices crosswise and lengthwise with the knife.

When the students have seen everything that they think there is to be seen, let them write a description of what they have observed. They should be asked to make this description as terse as possible, using their own language and not resorting to the book for terms.

The teacher should then examine these descriptions, in which he will doubtless find much omitted. I should then make the study of the same shoot the subject of the next class exercise, in which I should point out each feature that I wished examined, giving sufficient time for the inspection of each part. I should also endeavor to show that for the circumlocutions in their descriptions there are often single words (technical terms). The pupils will thus come to know something of the method of accurate and thorough observation, and will discover that technical terms are not hard words invented for their discomfiture, but short ways of expressing the ideas gained.

At the close of this exercise I should call upon each pupil to draw carefully a portion of the shoot showing as many of the facts observed as possible. Drawings should also be made of the dissected parts. Here the teacher will be met by the objection on the part of the pupils that they cannot draw; but as that is only another way of saying that they cannot see accurately, he will have to insist on their doing the best they can, with the assurance that as power of accurate observation increases the accuracy of the drawings will increase in the same ratio. He should be able to lead here as at other difficult places. Happy he if he be not a blind leader of the blind.

After studying several other shoots in the same way, I should assign the lesson in the text on buds and branching.

The points specially emphasized here are: 1. Study of the plants themselves. 2. Drawing and describing observations. 3. Afterwards the study of the text-book. 4. Supplementary reading, particularly as to the function of the parts studied.

Topics for Further Study.

Following this method with each organ, the following topics are suggested:

Underground stems: potato (tuber); onion (bulb); cyclamen or Indian turnip (corm).

Structure of stems: cut thin slices of both herbaceous and woody stems and examine in water. Bean, sunflower, geranium, hyacinth, and twigs of forest trees may be used.

Leaves: structure of blade and petiole; forms of stipules; character of venation, particularly with reference to function of veins. Reference readings on the function of foliage leaves are particularly important. Study of the unfolding leaves in spring is specially desirable.

Flowers: parts; forms; flower clusters, etc. I need enter on no details as to these parts, since they are treated so fully and have always received overmuch attention because of their importance to classification.

Let it be remembered in the study of all these topics that it is not a memorizing of the technical terms of descriptive botany that is wanted, but a study of structure of the parts with reference to function. Insist on the pupil constantly asking himself, "What is this for?" As to technical terms; if they are not acquired as a convenience they would better not be acquired at all.

Some time should be taken before the close of the year to study the lower plants. It is an excellent plan in the spring to organize "forays," on which pupils can collect every form of plant they can lay their hands on, ferns, toadstools, lichens, parasitic fungi, algæ, etc. Preserve these[1] and have them studied. Directions for such study can be found in Arthur, Barnes, and Coulter's "Plant Dissection" (Henry Holt & Co.); Bower's "Practical Botany" (Macmillan & Co.); Bessey's "Essentials of Botany" (Holt); Campbell's "Structural and Systematic Botany" (Ginn & Co.).

Questions will be freely answered regarding any matters not elucidated above, and further suggestions will be made if desired. I should be glad to be of assistance to teachers in improving the work in botany.

CHARLES REID BARNES,
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A NEURO-EPITHELIOMA OF THE RETINA.[2]

THE possibility of the reproduction of the most highly organized structure of the human body has long been doubted and even denied. Until the publication of an instance by Professor Klebs of Zurich, in which the ganglionic cells of the central nervous system were found repeated in a tumor formation, this was not admitted to be possible. Even now not a few competent pathological histologists are not convinced of its occurrence. An interesting and important addition to this subject is that of Dr. Flexner. In this instance the rod and cone layer and the external nuclear layer of the retina were reproduced in a tumor.

The case was that of a child four months old. One eye was affected and removed, and then the remaining eye became the seat of a disease presumably of like nature. But nothing was permitted to be done for the second eye. Several years before this child was born another child in the same family, this one six months old, died in consequence of an eye tumor which returned. Two years after the case just related another child of the same parents, this one four months old, had a tumor of the eye which spread to the brain, also resulting in death. The one which is reported makes, therefore, the third instance of eye tumor in this family. There was no history of eye tumor in the immediate ancestors of the children.

The vitreous chamber of the eye was filled almost entirely with the growth. The latter was attached to the retina throughout a considerable part of its extent, and was seen to originate at a point of microscopical size situated in the external nuclear layer. The cells which made up the tumor consisted of two principal kinds.

[1] Every teacher should have some book with directions for preserving plants. The following are available: Bailey's "Collector's Hand-book" (Bates, Salem, Mass.); Penhallow's "Botanical Collector's Guide" (Renouf, Montreal); Knowlton's "Directions for Preserving Recent and Fossil Plants" (Part B, Bulletin 39, U. S. National Museum).

[2] "A Peculiar Glioma (Neuro-epithelioma?) of the Retina," by Simon Flexner, M.D., fellow in pathology. From the Pathological Laboratory of the Johns Hopkins University and Hospital. The Johns Hopkins Hospital Bulletin, No. 15, 1891.

Those present in predominating number are probably not the entire cells, but are described as such for the sake of brevity. They present the appearance of sharply stained nuclei, with scanty, often indistinct, even apparently absent, cell bodies, and in favorable places their fibre-like processes can sometimes be traced a short distance from the cell bodies. These bodies often appear as round cells, and they are spoken of as such in this article, but they have a more complicated structure than this designation would imply. The next most important cells are larger than the round cells, but their nuclei are not larger than those of the round cells. These cells are usually of a columnar or rod shape, but sometimes they appear to be conical. The nuclei invariably occupy the broader ends of the cells, and each cell presents opposite to the nucleus an acute terminal process. Finally, from the extremity of the cells can sometimes be seen a stalk-like prolongation which passes down between the round cells and probably becomes united with them. The disposition of the various cells of the tumor is important. The columnar cells arrange themselves in the form of circles or rosettes, and this is accomplished through the juxtaposition of the sides of the cell bodies, the acute ends of the cells pointing towards the centre of the circle, while the periphery is formed by the broad ends of the cells containing the nuclei. The latter vary in size, depending on the number of cells concerned in their formation, and where the acute ends of the cells are in opposition, and just before their termination, a very fine, although distinct, membranous ring is formed, and projecting beyond this ring the delicate processes of the cells forming their acute ends may be observed. The round cells above described surround the rosettes. These tumor cells are in many ways identical in appearance with the external nuclei and rod and cone layer of the retina, as the author shows.

"If morphologically it is impossible to distinguish between the round cells of the tumor and the cells of the external nuclear layer of the retina, so do we consider that in each of the numerous rosettes can be seen the rod and cone layer of the retina reproduced in miniature. For it is possible to see in the membranous ring the external limiting membrane of the retina, beyond it, projecting into the lumen of the rosettes, the delicate processes of protoplasm corresponding to the rods and cones, and opposite to these the nuclei to which these processes are united And then surrounding these nuclei, which form a part of the external nuclear layer, as it were, are the numerous round cells which are indistinguishable from the cells of the external nuclear layer. It is not to be considered that in every rosette the matured rod and cone layer of the retina is reproduced· While this is the case in some of them, others show a structure suggesting the embryonic type. Hence this tumor is regarded as one in which the two most external layers of the retina have been reproduced."

The second part of the paper is devoted to a discussion of applicability of the term "glioma" and the suggestion of the name "neuro-epithelioma," and then with a consideration of the question of the embryonic origin of tumors in general.

A SEEDLING BLACKBERRY PLANT.

WHEN poor little "Jo" of Bleakhouse was told to "move on," he did not appreciate the fact that everything in nature is impelled by irresistable forces to "move on" to a higher plane of existence, or suffer the only alternative, extinction. Plants and animals must be able to respond to changed conditions, must adapt themselves to their ever changing environment by various modifications.

Grant Allen has written some exceedingly interesting chapters on the genealogy of certain plants. Nature seems to have dropped a magic key into his hands, which admits him directly into her presence, and he relates with charming grace what she imparts to him. Although it requires a skilled expert to "Dissect a Daisy," any one who will, may read the fascinating story of evolution which is written on the leaves of many plants.

Now, here is a little seedling blackberry plant, which we will take for our text. You will notice at the merest glance that the leaves are quite dissimilar. The one nearest the base being simply a plain, ovate leaf, with an irregularly serrated margin. I wish you to notice particularly a certain peculiarity in the venation of this leaf, viz., that the first pair of veins near its base are quite prominent; that, leading from these veins on the lower side, are also well-marked veins; while on the upper side there are none, or very inconspicuous ones. There does not seem to be anything striking or of especial interest in these facts, but, like the "magic pear," which the artist, with a few strokes, converts into a face, this peculiarity becomes gradually emphasized, until later on in the series it may be called a characteristic.

The second leaf differs somewhat from the first one, the outline is more irregular. If, however, we read just a little between the lines, we will see that it really has taken quite a stride in advance; a little more careful examination will reveal, what perhaps escaped our notice at first, that the difference between these two leaves does not consist wholly in difference of outline. Again, it will be observed, the

A SEEDLING BLACKBERRY PLANT.

pair of veins near the base of the leaf are prominent, the smaller veins leading from them being also well-marked, on the lower side only.

With a little imagination, we can perceive that Nature is busy at work with this "magic leaf," and has already conceived the idea of evolving from it the trifoliate leaf. With this idea in mind, we can readily understand the significance of the prominent veins, to which your attention has already been called. We may consider them the frame-work of the undeveloped leaflets. A notch is quite plainly seen on each side of this second leaf, which nature evidently wishes to continue and deepen until a new leaflet is given off on either side. As if to render this result more easily accomplished, she has omitted the frame-work in the portion of the leaf where division is to take place. As proof that our imagination has not led us astray in our prediction as to nature's plan, we have leaf No. 3 of our seedling. This leaf has actually given off a leaflet on one side, and is evidently husbanding its forces for the elaboration of another on the opposite side, the outline of which is already suggested by the characteristic venation on the lower or outer portion. We may almost say that half the leaflet is even now evolved.

Nature had these little leaflets in mind long before she brought them forth, as shown by the veins on the first leaf of our little seedling.

But let us return to the perfect leaflet, which has been given off and now enjoys the responsibility of individuality. Observing it carefully, we discover that nature has planned a repetition of the process of division. Leaf No. 4 demonstrates the progress of this conception. The new leaflets can be readily perceived, though they yet live with the mother leaflets, if we may so designate the latter, which continue to elaborate nourishment for their offspring until they no longer need direct parental care.

In leaf No. 5, nature has almost reached the highest type of blackberry leaf of the present. In it, the fifth leaflet is about to bid adieu to its mother-leaflet; it stands on the threshold of individual existence; soon it will reach maturity and have a petiole all its own. The truth of this assertion is demonstrated by leaf No. 6, which represents a normal blackberry leaf, with five fully developed leaflets.

Nature never does anything in a hurry. Whether it took ages or æons to evolve the five leaflets from the single leaf we do not know, but he who runs — through a blackberry patch — may read on every plant or bush some chapter of the story of evolution she has written on the leaves. The single leaflet will not be met with so commonly, but various stages of transition, from three to five leaflets may be found on any blackberry plant.

Agassiz insisted that the laws of geological succession and embryonic development are the same, that embryology, or the development of the individual, is an epitome of the development of the entire series. In the leaves of the seedling blackberry we have, as it were, an epitome of the evolution of the blackberry leaf from the ancestral form to the present type.

The social world is sometimes disturbed and startled by the appearance of a reformer, who casts from him superstitions, dogmas, old beliefs, and mounts to a higher mental plane. So, too, there are reformers among plants; for instance, a blackberry leaf of six or seven leaflets is sometimes found; it is true such leaves are considered monstrosities, or abnormal specimens.

If we again permit ourselves to read between the lines, will we not be able to see in these abnormal leaves that nature is at work now as in the past? Favorable conditions and hereditary influence are now, as formerly, the tools she furnishes her favorites for working out their evolution.

The trifoliate leaf existed in embryo, as it were, in our ancestral seedling leaf. Nature said, "Move on!" When the whole brotherhood had reached the dignity of the perfect trifoliate leaf, she bade them still "move on!" All have not yet attained to the degree of progress represented by the five leaflets. But nature will continue to "move on," and the occasional reversions and reformers are the sign-boards which indicate to us the road she has taken.

MRS. W. A. KELLERMAN.

Columbus, Ohio.

NOTES ON THE FOOD OF THE BOX TORTOISE.

SEVERAL years ago, walking one morning in a wood in Pennsylvania, I surprised a wood turtle or box tortoise eating his breakfast. The season had been rainy, and many varieties of large fungus had attained a prodigal growth. The woods were full of what are popularly called toadstools; many of them were of the diameter of a tea plate, and stood five or six inches high. As I walked through the wood I observed that many of these fungi had been gnawed off evenly, as if cut by a knife, leaving only the central pillar intact. What had done this? I soon discovered, for moving noiselessly over the mossy earth, I came to a little opening, where grew one of the finest of these toadstools, and there was a wood turtle taking his breakfast.

The animal had already made one or two rounds of his plate, and was eating with praiseworthy deliberation. He would bite off a mouthful of toadstool, chew it carefully until he had extracted all the juice, then open his mouth and drop out the chewed fibre, and take a fresh mouthful, biting not inward toward the stem, but breaking off the morsel next beside that which he had just eaten. He paced round and round the fungus as he took his bites, eating his plate like Æneas and the other Trojans, and as the fungus decreased in regular circles the circle of chewed fragments increased. In three quarters of an hour he had eaten all the disk of the fungus to the stem part, and then he walked slowly off to look for another.

I found the crumbs that had fallen from his vanished table quite dry, nothing nutritious being left in them. Why he rejected the central part of the fungus and the stem I could not imagine, but he left it in every instance. If he came upon a decayed or wormy portion of the toadstool he did not "bite round it," but abandoned it altogether and went for a fresh one.

Last summer I took home with me a box tortoise to experiment on feeding it. He ate flies and other insects from my fingers at once, showing no signs of fear; he ate bread and milk with evident relish. I put a blackberry in his open mouth and he closed upon it, but at once, with every appearance of deep disgust, stretched his mouth wide open, and, taking his right front paw hand-wise, wiped all the berry from his mouth. He repeated this performance many times, both with blackberries and blueberries, always using his right paw to cleanse his mouth.

J. McNAIR WRIGHT.

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.*

On request in advance, one hundred copies of the number containing his communication will be furnished free to any correspondent.

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

Hypnotism among the Lower Animals.

THE power attributed to the snake and feline families, of "charming" their victims, seems to me past dispute. Is it not merely a form of hypnotism? Livingston tells us that when at one time seized by a tiger, he felt neither terror nor pain, all his senses seemed to be benumbed. Bates, in his "Naturalist on the Amazons," states that one day in the woods a small pet dog flew at a large rattlesnake. The snake fixed its eyes on the dog, erected its tail, and shook its rattle; it seemed in no haste to seize the dog, but as if waiting to put the dog into a more suitable condition for being seized. As to the dog, it neither continued the attack nor retreated, could not or would not move when called, and was with difficulty dragged away by its master.

I have seen one case of a snake charming a bird, but I had a better opportunity to study a cat charming a bird, and probably the process is much alike in both.

The cat placed itself on the outside sill of my window, near to a pine tree. A bird presently lit on the pine tree, no doubt not observing the cat. The cat fixed its attention on the bird. The cat's eyes were widely opened, and shone with a peculiar brightness; its head was raised and intent, the fur on its neck and about its face slowly stood up, as if electrified. Except for this rising of the fur, and a certain intensity of life in the whole attitude of the beast, it was as still as if cut from stone. The bird quivered, trembled, looked fixedly at the cat, and finally, with a feeble shake of the wings, fell towards the cat, which bounded to seize it.

A lady tells me that she "does not believe that cats can charm birds, because she has seen a cat try to charm a parrot, and the bird, greatly alarmed, scolded loudly." This proves nothing, the parrot in general, or, more probably, that particular parrot, did not prove a good subject for the mesmeric power. I have seen people who cannot be hypnotized; they resent the effort, and nervous action becomes intensified. J. McNAIR WRIGHT.

AMONG THE PUBLISHERS.

THE W. J. Johnson Co., limited, have ready "The Electric Railway in Theory and Practice," a complete treatise on the construction and operation of electric railways, by O. T. Crosby and Dr. Louis Bell, fully illustrated and wholly practical.

— Henry Holt & Co. will shortly publish a translation of "Geschichte der Philosophie," by Dr. W. Windelband, professor in the University of Strassburg.

— Thomas Nelson's Sons have ready an entirely new atlas by J. G. Bartholomew, entitled "The Graphic Atlas and Gazetteer of the World," with over two hundred and twenty maps, charts, plans of cities, etc., all revised to present date, and a gazetteer of nearly 55,000 places and results of new census. Throughout the atlas the countries of the world have been treated with fulness in proportion to their commercial importance and interest. In the United States section a separate map is given of each of the States and Territories. The Canadian provinces are treated in similar detail. The maps have been specially compiled from the latest and best government survey maps, and have undergone local revision for the verification of new counties, townships, and railways. Considering the vast amount of information given, the atlas is a marvel of compactness and practicability.

— The most important work on the general study of linguistic science that has appeared in 1891 is that of Professor Georg von der Gabelentz, "Die Sprachwissenschaft, ihre Aufgaben, Methoden und bisherigen Ergebnisse," Leipzig (Weigel, publisher), pp. xx. and 502. The wide-reaching and comprehensive scope of this treatise is shown by the very title, and readers will soon see that the author fulfils what he promises. Through his great practical experience the author, well known as a connoisseur of eastern Asiatic languages, is enabled to give more hints about linguistic studies and their scientific bearing than such men as have confined their energies to inflective languages alone. The volume gives us the views of a man familiar with all possible types of human speech, the monosyllabic as well as the incorporating and agglutinative, and introduces us in the most fascinating way into all the morphologic intricacies of the verb, noun-verb, and sentence. In its make-up the book comes nearest the celebrated "Principles of Language History," by Paul, and supplements it in many different ways, as it does also the works of Friedrich Müller and Whitney. There is no chapter in language-study which is not fruitfully hinted at or fully treated by the author: the composing of grammars, the analytic compared with the synthetic system, the various phonetic modes of recording languages, the medley languages, theory of roots, the tests of affinity, the possibility of composing scientific dictionaries, the analysis which is inherent in etymologic research, synonymic dictionaries, etc.

— Dr. Andrew D. White will open the March *Popular Science Monthly* with a chapter on "Astronomy" in his Warfare of Science series. The strenuous exertions made by both the Catholic and the Protestant clergy to suppress the teachings of Copernicus and Galileo are set forth in this article with such strong evidence as to admit of no denial or shifting of responsibility. "The Organ" will be the subject of the article in the American Industries series. The author, Mr. Daniel Spillane, describes some of the noted instruments in the United States, and shows that American organ builders have made good use of the scope for individuality which their art allows. The article is fully illustrated. Under the title "Social Statistics of Cities," the March number will have a paper by Carroll D. Wright, comparing the area and population, and the cost of each department of public works, in fifty cities of the United States. The comparison contradicts some prevailing opinions as to what cities have the most expensive governments. "The Cotton Industry of Brazil" will be described by John C. Branner, formerly assistant geologist of the Brazilian Geological Survey. Mr. Branner believes that the production and manufacture of cotton in Brazil is destined to increase, but that the country will not become a competitor of the United States in this industry.

— "Darwin after Darwin," is the title of a book that George J. Romanes is preparing.

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SCIENCE

NEW YORK, FEBRUARY 19, 1892.

NOTICE OF NEW GIGANTIC FOSSILS.

While on a collecting trip the past summer in the Bad Lands of north-western Nebraska and south-western South Dakota my attention was called by Mr. Charles E. Holmes

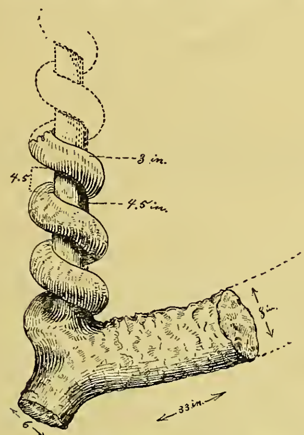

FIG. 1.—Devil's Corkscrew in the collection of C. E. Holmes. Drawn from nature.

(Yale, '84) to some gigantic fossils abounding in the extreme north-western corner of Nebraska. At that time I secured one large specimen, and noted and sketched several other forms, intending to return later and complete the work in that highly interesting field.

These fossils seem altogether so remarkable and of such imposing size and peculiarity of form, that I have felt great hesitancy in offering any suggestions as to what they are or in describing them at all; and what I now venture to publish is proposed tentatively, till I can return to this same spot and complete the work cut short last season. Not less than two genera and three species of the family were noted, and, because of their similarity to immense corkscrews, we dubbed them "Devil's Corkscrews," and I offer for them the provisional name *Daimonelix*. At least two gigantic and one small species were observed. They are almost mathematically exact and regular in form, and suggest a great three-inch vine coiled with strict uniformity of pitch about a four or five-inch pole. However, the vine and pole, as the cut will show, are just as much one as are the thread and screw which they so strikingly resemble. At the bottom of all is a transverse piece, indefinitely long, and about ten inches in diameter, rendering the appearance of the whole like that of the veritable corkscrew (See Fig. 1).

Just what this great "rizome" is, remains to be learned. In the mean time, suffice it to say, that, as far as observed, it consists invariably of a small obliquely descending portion, and a large obliquely ascending one. The latter, as shown by all that have been dug out, at least, seems to curve upward gradually, and ultimately reach the surface.

The great "underground" stem of my own specimen (Fig. 2) was followed from the wall of a small butte some ten feet straight into its interior, and then the work of further excavating in rock so very soft and crumbling, yet so peculiarly difficult to work, had to be abandoned. In the two remaining forms especially noted, one gigantic, the other small, the coil had the form and pitch of the common open corkscrew (see Fig. 3).

They covered an area of several square miles, where I saw large numbers of them, all standing in the incompletely lithified sandstone as erect as so many titanic hop poles with so many titanic vines coiled upon them. I estimated that many could not be less than thirty or more feet in height; at any rate, we frequently saw in the vertical walls of small cañons or draws fifteen feet of exposed corkscrews, while an unknown amount had been weathered from the top, and an indefinite amount was still buried in the rocks below. Then,

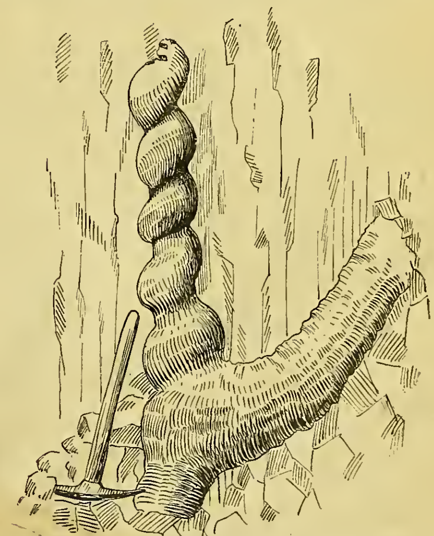

FIG 2.—A sketch of Devil's Corkscrew (in my own collection) as it appeared when nearly dug out of the vertical bank. Top eroded away. Height about five to six feet.

again, I dug out the basal portion of one specimen fully thirty feet below the surface, where the tip-ends of others were exposed. These strange forms seem to be casts, no structure being visible to the eye, or under the glass. The gray matrix readily weathers away from the specimen, which on fracture shows a spongy, friable, white wall, surrounding a core or matrix; though of chalky appearance, the wall is strictly silicious.

While reminding one forcibly of some monstrous fossil bryozoan, it seems improbable that it is such, neither is it a plant, nor a mollusk, as I believe. Possibly it is the case of some ancient worm. I have shown the specimen to eastern as well as western geologists and botanists, besides sending drawings and descriptions of it to others, who pronounce it entirely new to them. As far as my own experience goes, I have neither seen anything of the kind in any of our large eastern museums nor have seen anything published relating

FIG. 3. — Diagram of another form of Devil's Corkscrew, as sketched in the field.

to it, and I feel reasonable confidence in offering a notice of what I believe to be a new paleontological specimen, trusting that, if nothing more, it may elicit information on the matter from anyone who has it to offer.

IRWIN H. BARBOUR.

CONFIRMATION OF THE DISCOVERY OF THE INFLUENZA BACILLUS.

To Dr. Pfeiffer of Berlin is due the discovery of the influenza bacillus. Dr. Kitasato has cultivated it to the fifth generation. Koch has shown, in an article not yet published, how pure cultures of tubercle bacilli can be obtained directly from the sputum. Kitasato has succeeded in employing the same method with the influenza bacilli. According to him, the single colonies are so uncommonly small that they can be easily overlooked, so that former investigators may have failed to see them. The colonies do not flow together as in other kinds of bacteria, but always remain separated; this is so characteristic that the influenza bacilli can be distinguished from all other bacteria with certainty.

The same bacilli have been found in the blood of influenza patients by Dr. Canon. Dr. Koch has compared these with the micro-organisms discovered by Pfeiffer, and pronoun- them identical.

And now Dr. Canon has gone still f- ceeded in cultivating the influenza ba of patients attacked with the disease. -n is especially difficult since the bacilli in -od-drops are very few in number, and the colonies, on account of their fineness, are concealed through the coagulated blood. The blood therefore was not inoculated in tubes upon glycerin or sugar-agar, but in the Petrian "Schalen." A great quantity -as employed. By this method there was not only a greater -bability of preserving colonies, but also the possibility of -tually seeking out the colonies with the microscope.

- blood is taken in the following manner: a finger-tip -sed with sublimate, alcohol, and ether in the usual way; then with a red-hot needle the finger is pierced; an assistant presses the blood out of the opening in drops, being careful that they remain globular in form; from eight to twelve drops are placed upon the Petrian "Schale," and they are heated in a temperature of 37° C. The colonies show a slight development after twenty-four hours; in forty-eight hours they are distinctly seen. They are like those cultivated by Pfeiffer from sputum of influenza patients. In the cultures from the blood the colonies often lie close upon one another. The pure cultures from these colonies have the same appearance as those Kitasato has described.

Dr. Canon cultivated influenza bacilli from the blood of six patients, and in all the bacilli in the blood preparation were few in number and separated. And thus it appears that in those cases where the bacillus is wholly separated in the blood preparation, a sure diagnosis of influenza is given.

A. MACDONALD.

Georgetown Medical School, Washington, D.C.

1 Deutsche Med. Wochenschrift, Jan. 21, 1892.

NOTES AND NEWS.

THE University of Edinburgh in June, 1891, conferred upon Professor Simon Newcomb the honorary degree of doctor of laws (*in absentia*). Professor Newcomb was also elected, in June, 1891, an honorary member of the Royal Institution of Great Britain.

— At a meeting of the trustees of Johns Hopkins University, Dec. 15, 1891, it was determined to proceed to construct an academic hall on the property belonging to the university, at the corner of Monument and Garden Streets, running back to Little Ross Street. The trustees are enabled to take this important step by the gift of the late John W. McCoy, who made the university his residuary legatee. Sufficient funds have been received from his estate for the erection of a building which will furnish rooms for the classes in languages, history, and philosophy, with space for the present requirements of the library, and an assembly-room which will hold over six hundred persons. The trustees voted that the building should be known, in honor of the munificent donor, as McCoy Hall. The piece of ground on which the new hall is to be constructed is 100 x 185 feet, and is now taken up with residences used for purposes of the university. Messrs. Baldwin and Pennington have been selected to draw up the plans for the building.

— On 12th of May, 1890, while making a professional call in the outskirts of the town, B. H. Hartwell, M.D., of Ayer, Mass., was summoned into the adjacent woods by a messenger, who stated that her mother was "burned alive." In a paper read before the Massachusetts Medico-Legal Society, and published in the *Boston Medical and Surgical Journal*, Dr. Hartwell says: "Hastily driving to the place indicated (about forty rods distant) a human body was found in the actual state of conflagration. The body wa-

-en, and both legs. The flames reached from twelve to fifteen inches above the level of the body. The clothing was nearly all consumed. As I reached the spot the bones of the right leg broke with an audible snap, allowing the foot to hang by the tendons and muscles of one side, those of the other side having burned completely off. Sending my driver for water and assistance, I could only watch the curious and abhorrent spectacle, till a common spading fork was found with which the fire was put out by throwing earth upon it. The flesh was burned from the right shoulder, exposing the joint from the abdomen, allowing the intestines to protrude, and more or less from both legs. The leg bones were partially calcined. The clothing unburned consisted of parts of a calico dress, cotton vest, woollen skirt, and thick, red, woollen undergarment. The subject of the accident was a woman, forty-nine years of age, about five feet five inches in height, and weighing not far from one hundred and forty pounds; of active habits and nervous temperament. A wife and mother, she was strictly a temperate person, accustomed through life to hard work, one who, in addition to her household duties, went washing and cleaning, besides doing a good share of the work in a large garden. On the fatal afternoon she had — as the place showed — been clearing a lot of stumps and roots, and had set fire to a pile of roots, from which it had communicated to her clothing, or it had spread into the woodland and had set fire to the clothing during her endeavors to stop it. The body lay about two rods from the burning pile. As proof that the flesh burned of itself, and nothing but the clothing set it afire, it may be stated that the accident occurred after a rain; that the fire merely skimmed over the surface of the ground, not burning through the leaves; that there was nothing but charred leaves under the body; that her straw hat which lay several feet distant was simply scorched; that the wooden handle of the spade was only blackened. The above case is interesting in several particulars. It is the first recorded case in which a human body has been found burning (that is, supporting combustion) by the medical attendant. It differs from nearly all of the recorded cases, in that it occurred in a person in middle life, not very fat, and not addicted to the use of alcohol. It is interesting in a medico-legal sense. It proves that under certain conditions — conditions that exist in the body itself — the human body will burn. We have abundant proof in the many recorded cases of so called spontaneous combustion (seventy-three are chronicled in medical literature) that the body has been more or less completely destroyed by fire, under circumstances that show that it will support combustion, and this has given rise to the belief in the spontaneous origin of the fire."

— A gentleman in New York has recently tested the result of preserving a turkey in a refrigerator for ten years, says the *Boston Medical and Surgical Journal.* This time having elapsed, the fowl was removed from the refrigerator, and after being properly cooked was eaten by a party of gentlemen. While putrefactive changes seem to have been entirely absent it was found that the meat was practically tasteless.

— The annual general meeting of the Royal Meteorological Society was held on Jan. 27. Owing to the absence of the president, Mr. Baldwin Latham, through an attack of influenza, his address on "Evaporation and Condensation" was read by the secretary. The question of evaporation is of as great importance as the study of the precipitation of water on the face of the earth, as the available water supplies of the country entirely depend upon the differences between these two sets of observations. The earth receives moisture by means of rain, dew, hoar-frost, and by direct condensation. It loses its moisture very rapidly by evaporation. Although evaporation mainly depends upon the difference between the tensional force of vapor due to the temperature of the evaporating surface and the tensional force of the vapor already in the atmosphere, yet it is largely influenced by the movement of the air and by its dryness, or the difference between the dew-point and the actual air temperature. Evaporation goes on at night so long as the water surface is warmer than the dew-point. With sea-water the evaporation is about 4½ per cent less than with rain-water, while with water saturated with common salt the evaporation is 15 per cent less than with rain-water. In his experiments Mr. Latham used an evaporating gauge made of copper, one foot in diameter, and containing one foot in depth of water, which was floated by means of a hollow copper ring placed six inches distant from the body of the evaporator and attached to it by four radial arms. This form of evaporator was found extremely convenient in carrying on all evaporation experiments; it was floated in a tank four feet in diameter, containing thirty inches depth of water. During the period of thirteen years, from January, 1879, to December, 1891, this evaporator has never once been out of order or been interfered with in the slightest degree by frost. Experiments were made with some 5-inch evaporators as to the effect of color on the amount of evaporation, one being painted white, another black, and the results given by these gauges were compared with a copper gauge exposed under similar conditions. This comparison was the means of showing that the greatest errors in evaporating gauges arise from the capillarity of the water rising on the sides of the gauge and thus inordinately increasing the amount of evaporation. Consequently a small gauge having a larger amount, in proportion, of side area than a larger gauge, gives a very much greater amount of evaporation. The results from the floating evaporator, one foot in diameter, show that the average amount of water evaporated annually during 1879–91 was 19.948 inches. It was found, however, that, as a rule, during the period from October to March, there were certain occasions when condensation was measured. The amount of these condensations in thirteen years averaged .308 of an inch per annum The 5-inch evaporating gauge, freely exposed to atmospheric influences, gave during the same period (1879–91) an average annual depth of evaporation equal to 38.185 inches. The average annual evaporation during the three years 1879–81 from the 5-inch copper gauge standing in water was 27.90 inches, from one painted black, 22.97 inches, and from another painted white, 21.74 inches, whilst a gauge of the same dimensions, freely exposed in the atmosphere, gave in the same period 36.96 inches, and the 1-foot floating evaporator, 19.40 inches. The 5-inch copper gauge gave a larger amount of evaporation than the gauge painted black. Mr. Latham next described some percolation experiments which were carried out by Mr. C. Greaves at Old Ford, by Messrs. Dickinson and Evans at Hemel Hempstead, and by Sir J. B. Lawes and Dr. Gilbert at Rothamsted. He then detailed the results of his own experiments, and also the gaugings of the underground waters in the drainage areas of the rivers Wandle and Graveney. He further stated that in the course of his observations on the flow of underground water he had observed that at certain particular seasons of the year it was possible to indicate the direction and volume of the flow of underground streams, even when they were at a considerable depth, owing to the formation of peculiar lines of fog. Dr. C. Theodore Williams was elected president for the ensuing year.

— The *British Medical Journal,* in commenting on the death of a boy who died from drinking hot tea without milk, says that the tea had been left in the oven for some time, so that it had become a strong decoction of tannin. In being drunk without milk, the tannin was not brought into a relatively harmless albuminous tannate. It is on account of this method of making tea that it is so injurious to digestion. Neither the Chinese nor the Japanese, who know how to make tea, use milk with it; but with them the hot water is poured on and off the leaves at table, and it is drunk as soon as it becomes a pale straw color. No people in the world drink so much tea as the Japanese, yet in Japan it is never injurious to the digestion, as by their method of preparation the tannin is not extracted from the leaves.

— There will shortly be opened, probably early in March, in the Museum of Archæology of the University of Pennsylvania, a loan collection of objects used in religious ceremonies, including charms and inplements used in divination. The basis of the exhibition is the collection of oriental idols of the Board of Foreign Missions of the Presbyterian Church in the United States, comprising objects sent home by foreign missionaries through a period of sixty years. They include a series of Indian brass and marble idols, and a representative collection of Chinese deities and ancestral tablets. There are also a number of African idols from the well-known missionary station on the Gaboon River. This collection is supplemented by numerous loans from private collections and objects from different sections of the museum. A catalogue is in course of preparation which will contain sketches of the great religions of the world by Mrs. Cornelius Stevenson, Dr. Daniel G. Brinton, Dr. Morris Jastrow, and others. Ancient Egypt, India. Burma, China, Thibet, Japan, Aboriginal America, Polynesia, and Equatorial Africa will be represented by appropriate specimens, which are now being arranged and catalogued.

— At the opening session of the seventy-first meeting of the American Institute of Mining Engineers at the Johns Hopkins University, Baltimore, Md., on Tuesday evening, Feb. 16, M George F. Kunz read a paper on the mining of gems and mine in the Ural Mountains, illustrating his remarks with lantern s' made by himself on his trip last summer.

— The following experiment is reported in bulletin No. 15 of the Georgia experiment station: The object of this experiment was to determine the effect of applying varying quantities of each of the three elements — nitrogen, phosphoric acid, and potash. The section selected comprised one acre of very poor, gravelly soil, underlaid by a yellow pebbly clay, inclining to pipe clay. The original growth was scrubby post oak, red and yellow oak, and the soil is probably the poorest on the farm. It was in corn in 1890, fertilized at the rate per acre of 160 pounds of super-phosphate, 170 pounds of cotton seed meal, and 80 pounds of muriate of potash. The yield was 18 bushels of corn. The land was well broken, April 8, with a one-horse turn-plow, and harrowed smooth. April 14 it was laid off into fifty-two rows, running east and west, and four feet wide, using a long scooter, followed by a shovel. The section was then divided in the middle, across the rows, and grouped into plots of three rows each, extending half across the acre, from the west to the middle line, and from the middle line to the east side. The plots were numbered from 1 to 17, commencing on the north side of the west half and extending to the south side; then from 18 to 34, continuing from the south side of the east half to the north side. The normal or standard formula was: 156 pounds super-phosphate, 19.4 pounds of muriate of potash, and 32.4 pounds of nitrate of soda. This formula was applied to plots 1, 10, 18, and 27. On the next succeeding plots, 2, 11, 19, and 28, the potash was doubled, the other ingredients remaining the same. In the next series, plots 3, 12, 20 and 29, the nitrogen was doubled, the others remaining normal. In the fourth series, plots 4, 13, 21, and 30, both the potash and the nitrogen were doubled, phosphoric acid remaining normal. In the fifth series the phosphoric acid and potash were doubled, nitrogen remaining normal; and so on through to the eighth series. Plots 9 and 26, abutting each other, contained four rows each, and were not fertilized. By this arrangement of the plots inequalities in the character and productiveness of the different portions of the acre were approximately adjusted or corrected. In the table following the results are given, the yield in the case of the unfertilized plots being the average of two plots, and in every other case being that of four plots.

Series.	Fertilizers Per Acre.			Cost Per Acre.	Yield Per Acre.
	Super-phosphate.	Muriate of Potash.	Nitrate of Soda.		
1	156	19 4	32 4	$2.36	7 62
2	156	38.8	32.4	2.77	7.94
3	156	19.4	64.8	3.06	8.34
4	156	38.8	64.8	3 48	8.84
5	312	19.4	32 4	3.58	8.12
6	312	38.8	32.4	4.00	7.93
7	312	19 4	64 8	4.29	8.95
8	312	38.8	64.8	4 71	8 46
9	—	—	None.	—	5.00

— Dust, like the poor, we have always with us, nor h... with her newest brooms yet succeeded in banish... is abundant evidence to show that a dust... lurking potentialities of mischief than a ju... hungriest wild beasts. To the researches ... others can now be added, says the *British Medical ...urnal*, the results of an elaborate investigation by Dr. Luigi Manfredi of the composition of the dust of the streets of Naples. The number of microbes of all kinds found in it amounted on the average to ..61,521,000 per gramme. Remarkable differences in the proportion of micro-organisms were, however, observed in the dust from ...ferent quarters of the city. Thus, in the streets least exposed ...ontamination, that is to say, where there was the least traffic ...where the hygienic conditions were most satisfactory, the ... number of microbes in the dust was only 10,000,000 per ... On the other hand, in the busiest thoroughfares, the average rose to 1,000,000,000, and in some of the dirtiest streets to the enormous figure of 5,000,000,000 per gramme. In this "endless ocean" of infinitesimal life, there was a large number of pathogenic organisms, and the unhealthiness of the street or quarter was directly proportional to the number of microbes in the dust. Dr. Manfredi carefully tested the infective power of the dust, and obtained positive results in 73 per cent of his experiments. Of forty two cases in which he communicated disease to guinea-pigs by inoculating them with Neapolitan dust, he found the microbe of pus in eight, the bacillus of malignant œdema in four, the bacillus of tetanus in two, the bacillus of tuberculosis in three, not to mention several other microscopic *feræ naturæ* possessing the power of inducing fatal septicæmia in the unfortunate guinea-pigs on which they were tried. The moral pointed by these discouraging facts is that our Ædiles should take the Dutch housewife for their example, and wage relentless war against dust and dirt of every kind.

— Professor William Guy Peck of Columbia College died suddenly in Greenwich, Conn., on Feb. 7, aged 72 years. He published, in 1859, "The Elements of Mechanics," in 1860, an edition of Ganot's "Physics," and was joint editor with Charles Davies of the "Mathematical Dictionary and Cyclopedia of the Mathematical Sciences." He wrote several other text-books in mathematics.

— The Institute of Jamaica has begun the issue of special publications. The first, the "Rainfall Atlas of Jamaica," contains thirteen colored maps showing the average rainfall in each month and during the year, with explanatory text. The maps are based upon observations made at 153 stations from about the year 1870 to the end of the year 1889. The available stations are irregularly distributed, being for the most part sugar estates and cattle-pens, and in consequence of this irregularity the island has been divided into four rainfall divisions. The north-eastern division has the largest rainfall, then comes the west central, next the northern, and lastly the southern. The annual distribution of the rainfall varies from 30 to 35 inches in a few places to over 100 inches in the north-eastern division. The greatest fall is in October, and the least in February. The driest stations are on the north-eastern and south-eastern shores. The maps show the distribution and average amount of rainfall very clearly by different tints, and cannot fail to be of both scientific and practical utility. The work has been prepared, according to *Nature*, by Maxwell Hall, the government meteorologist.

— The Equatorial current of the Pacific Ocean, striking against the Philippines and the islands lying to the south of that group, divides into two branches (*The Scottish Geographical Magazine*, February, 1892), one of which turns southwards to the coast of Australia, while the other, under the name of Kuro Shiwo, or Black Stream, flows past the Liu-Kiu Islands and the coast of Japan. Coming from the warmer equatorial regions, its waters have a higher temperature than that of the sea through which it passes, and hence its limits may be determined by observations of temperature. Its breadth and velocity are greatly modified both by the monsoons of the Chinese Sea and by the storms of the Pacific. In fai... line ...

... northern boundary. Its course is marked by ... and drift-wood, and also by the dark color to which it owes its name. From Rock Island it runs past Nosima Saki into the Northern Pacific. On the northern edge of this stream no current is found as a rule, though occasionally a current in the opposite direction has been noticed. Between the zone where no marine currents are found and the coast of Japan tidal currents occur. The breadth of the zone between the Kuro Shiwo and the coast increases during violent northerly winds, and diminishes when southerly and easterly winds prevail. When the latter blow steadily and with great strength, the current sets more or less directly onto the coast, causing high tides, and it is then necessary for ships to keep a sharp lookout, lest they should be driven ashore. The zone of tidal currents extends for a distance of five to six nautical miles from the coast, and their velocity varies in general inversely as the breadth of this zone. At Oshima the tidal current is sometimes imperceptible, either because it is overpowered by the Kuro Shiwo, or because at that time it flows through the strait between Oshima and the main island.

— The New York Industrial Building, erected during the past year, is nearly ready for use. The furniture dealers will be the first to occupy the building, and other trades have bespoken it so that there will be a continuous exhibition or fairs of varying kinds. The building is in a most fortunate situation, occupying the block bounded on the east by Lexington Avenue, on the west by Depew Place, on the north by Forty-fourth Street, and on the south by Forty-third Street, within a short block of the freight depot of the Grand Central Railroad, and within reach of all the street cars connecting with the ferries by which New York is approached from New Jersey, etc.

— The influence of steam on magnets is the subject of an interesting note in the *Schweizerische Bauzeitung*, in which reference is made to the researches of Strouhal and Barus. These have shown that, with long continued heating in steam, magnets lose from 28 to 67 per cent of their power. If, after this, the magnets are remagnetized, and again exposed to the action of steam, only a very slight loss of magnetic power is found to take place. The experiments which have been made would seem to warrant the conclusion, also, that after such treatment a magnet is less liable to deterioration from mechanical vibration as well as heat. In one of the experiments a short magnet was boiled in water for four hours. It was then magnetized and held in an atmosphere of steam for two hours more, after which its magnetic moment was measured. It was then subjected to fifty blows from a piece of wood, both transversely and longitudinally. Again measuring, its magnetic moment, showed a loss of $\frac{1}{900}$, and, on repeating the hammering with the wooden bar, the loss was $\frac{1}{400}$ of the original moment. In view of this, repeated steaming and magnetizing is recommended as a good means of securing permanent magnetism in pieces of hard steel.

— The Orang-Ulu are a people living in the southern part of Sumatra, who were visited by M. J. Claine during the summer of 1890 (*Asiatic Quarterly Review*, October, 1891). In May he arrived at Palembang, formerly the capital of the sultans of Palembang and now the seat of a Dutch resident. This town, containing a population of 60,000, composed of Malays, Arabs, Chinese, and a few Europeans, is situated on the Kuraa Sunsang, a branch of the Musi. Leaving Palembang in August, M. Claine ascended the Musi and its affluent, the Lemattang (Lamatang), to Muri-Enim (Muara Inim), about 186 miles from Palembang. Two days later the land journey was commenced, and, after a few hours' march, the country of the Orang-Ulu was entered by a bridge guarded by a group of natives. At Lahat the curious peak of Bukib Segello (Cerillo?) was photographed, and at Bandar, the last fortified post of the Dutch Government, a halt of two days was made. The country is mountainous and wooded, with here and there fine plains. The head-waters of the Lemattang run through profound gorges, and aborescent ferns afford a welcome shade from the burning rays of the sun. Soon after leaving Bandar M. Claine came in sight of the rich plateau of Passumah and the superb outlines of the Dempo, strongly marked against the sky, and came to a halt at Pager-Alam. The Ulu are very similar to the Malays in outward appearance and costume, but, never having adopted Mohammedanism, they differ in their habits. Each village is governed by a *Creo*, or chief, who wears, as a sign of authority, a pair of gold-woven pantaloons, provided by the Dutch Government. His power is very limited, all his acts being controlled by the elders. The chief occupations of the men are smoking and cock fighting, while the women do all the hard work. They grow rice and cocoa-nut trees. The houses, like those in other parts of Sumatra and Java, are built on piles, and entered by means of a notched beam. The husband, on his marriage, is bound to enter the service of the wife's family. Marriage is celebrated with the following curious ceremony: An immense balance, adorned with leaves, is placed before the house of the bride, in one of its wooden scales the parents deposit fruit, rice, fuel, cocoa-nuts, and a small kid, and in the other the bridegroom is bound to lay before sunset the gifts he makes to his intended. As soon as the scale dips in his favor, the girl leaves the house and approaches him, and the ceremony is concluded by a feast and dance. On the 11th of September M. Claine set out with a Dutch officer to ascend the Dempo. Passing by the village of Gunong Agun, through a region abounding in tigers, they reached the summit on the second day, and then, crossing a long and narrow plateau, ascended the Merapi volcano, visited seven years before by Mr. H. O. Forbes. The barometer marked 9,000 feet at the summit. From Pager Alam M. Claine made a tedious journey across the Passumah plateau to Padang-Bornay and Talang-Padang, crossing the Upper Musi several times by bamboo bridges. At Tebbing-Teggi (Tingi) he took passage on a coffee *prauw*, and descended to Palembang. The current is so rapid that it takes forty-five days to ascend the river, whereas three-fourths of the descent is accomplished in three days, and the remainder in four days and four nights.

— It has been proposed through the pages of the *British Journal of Photography* that upon the advent of the twenty-first birthday, in 1892, of the gelatino-bromide dry plate process, in photography, a substantial and fitting testimonial should be offered to Dr. R. L. Maddox, the inventor, now a veteran invalid, who has derived no pecuniary advantage from his valuable discovery, which has so largely advanced the progress of photography in all its branches, and in every country. For this purpose a committee has been formed in London, in order to carry out the scheme in the United Kingdom of Great Britain, consisting of the following gentlemen: Mr. James Glaisher, F.R.S., president of the Photographic Society of Great Britain, chairman; Captain W. de W. Abney, C.B., F.R.S., R.E., Messrs. A. H. Harman, F. York, and Sir H. Trueman Wood, assisted by others, as the executive, with the aid of Dr. A. Clifford Mercer, F.R.M.S., Syracuse, N.Y. For the furtherance of this project internationally, a foreign committee has been formed in Southampton, of the following gentlemen: James Lemon, Esq., Mayor of Southampton; Col. Sir Charles W. Wilson, K.C.B., F.R.S., R.E., director of the Ordnance Survey, Southampton; Major-General I. Innis-Gibbs, Captain Robert Evans, R.N. Subscriptions can be forwarded to the Southampton Branch of the National and Provincial Bank of England, by check or bank draft, crossed "Maddox Fund," or by post-office order; but, if preferred, they can be addressed direct to the secretary, Charles J. Sharp, solicitor, 71 French Street, Southampton, and will be acknowledged by him.

— The outlook for the recently discovered coal mines in the Argentine Republic is so favorable, according to *Engineering*, that the railway companies of that country have declined to renew their contracts with the British mines for fuel. Hitherto all the coal burned on the Argentine railroads has been imported, but it is believed that the newly-discovered mines will furnish a supply entirely sufficient for domestic consumption.

— Mail advices from the Argentine Republic bring information of the discovery of a vast bed of silver in the bottom of the bay of San Blas, Argentine Republic. The silver appears in the black metallic sand which covers the bottom of the bay. This sand is full of silver pellets, and divers have brought up a sufficient quantity to justify the belief, as stated by the Buenos Ayres *Standard*, that "the silver deposit in the bottom of the bay is greater than in the famous Bonanza mines of California."

— About four years ago there was inaugurated in Berlin a series of popular lectures on astronomy, illustrated with stereopticon views. This series has proved so successful that it has continued till the present time, and within ten days a similar course has been opened in New York. The lectures are given at the Carnegie Music Hall three times a week, and are entitled "A Trip to the Moon." The views shown are excellent and must certainly impress on those seeing them many an important fact in astronomy. The matter given by the lecturer varies somewhat as occasion may require.

— William Draper Lewis, Ph.D., is the author of a pamphlet recently published by the American Academy of Political and Social Science. The title of the essay is "The Political Organization of a Modern Municipality."

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ARSENICAL POISONING FROM DOMESTIC FABRICS.

PHYSICIANS long ago associated a certain class of symptoms with the presence of arsenic in the wall papers of the rooms inhabited by their patients. Of course, so long as the question was in this condition there was abundant room for mistake, and all that had been observed might be explained by some chance coincidence. It now appears that whenever the class of symptoms referred to are well marked there is arsenic present in the urine. It further has been shown in a number of cases that when the suspected wall paper was removed the arsenic disappeared from the urine of the patient, and the symptoms disappeared as well. The number of cases is large in which these points have been made: a certain class of symptoms, arsenic in the wall paper, arsenic in the urine of patients, wall paper removed, arsenic disappears from the urine, symptoms disappear in proportion.

Of course this is not absolute proof that the arsenic came from the wall paper, but, after a large number of cases of the same sort, the evidence amounts to moral proof, and it is rare in medicine to obtain evidence that is more conclusive.

How the arsenic gets from the wall pap[illegible] another question; but, although it would [illegible] establish this point, the proof of the *modus* [illegible] essential so far as the legal aspects of the ca[illegible] [illegible]ned. Without this last proof it is easy to throw dust in the eyes of those not versed in such inquiries, but protective legislation has been taken again and again in cases where the risk is far less than here.

"The question how the injurious effects are produced by arsenical colors in our domestic fabrics is a moot point, some thinking it arises from arsenical dust, others holding to the gaseous theory."[1]

[1] Lecture on our Domestic Poisons, by Henry Carr, London, Health Exhibition Literature of 1884, Vol. IX., p. 189.

A New York chemist testified in a hearing on the subject in Boston, "I found that a botanist named Selmi, in experimenting on mould, found it produced a little hydrogen, and he invented the suggestion that the mould on the back of wall paper might produce a little hydrogen, which might unite with the arsenic on the front of the paper, and produce arseniuretted hydrogen, which might account for the popular idea that arsenical wall paper was dangerous."

This "botanist named Selmi," who may have the advantage of a knowledge of that science also, is an Italian chemist of first-class reputation, who has been publishing his work for at least eighteen years since 1874, and has devoted himself lately more especially to physiological chemistry. He is mentioned in Henry Watts's "Dictionary of Chemistry," Third Supplement, p. 122 (1879), by this reference, "On the detection of Arsenic in Toxicological Investigations, see Selmi (Gazz. Chim. Ital., II. 544)." An interesting paper has lately been issued by the Italian Ministry of the Interior from the scientific laboratories of the Bureau of Health, under the direction of Professors A. Mouari and A. Di Vestea, prepared by one of Selmi's countrymen, Dr. B. Gosio, assistant in these laboratories, the following translation of which I am sure will interest your readers and assist in the solution of this problem. GEORGE S. HALE.

Action of Microphytes on Solid Compounds of Arsenic: A Recapitulation, by Dr. B. Gosio.[1]

It is well known that, under certain conditions, poisonous products may be developed from wall papers and tapestries colored with arsenical colors (Scheele's green, Schweinfurth's green), and experience has repeatedly demonstrated the serious evils that may arise from their use.

But as to the internal mechanism by which the said coloring-matters become hurtful, many doubts remained, and on certain points perfect obscurity. The idea advanced by Selmi met with favor, viz., that poisonous gases may in such cases be produced by the vital processes of microphytes; but in view of the small range of his experiments (some of which gave results adverse to his theory although tried on a large scale) the preference is given, on the whole, to the theory of William Forster. He says that wall-hangings and tapestries containing arsenical colors are poisonous by reason of the solid particles that are mechanically set free from them and penetrate the organism when inhaled in the form of fine dust. The same conclusion was reached by Giglioli of Naples after eight months of experiment on mould-cultures in earths (both solid and broken up in water), mixed with arsenious anhydride; and he explained [illegible] by saying that probably [illegible] [illegible] of the parasitic theory, [illegible] their observations only general crite[illegible] have not been able, thus far, to point out what micro-organisms are peculiarly suited to bring about the modifications of substauce to which they refer; nor have they determined whether all the compounds of arsenic, or, if not all, which of them are most susceptible of these modifications. Thus, Bischoff relates that it was noticed that from a mixture of flour and common white arsenic (which had been used to poison a horse for purposes of revenge) a gas was developed which had the smell of garlic and the characteristics of arseniuretted hydrogen. But he neither states how it was found

[1] This study was communicated in advance to the last Congress of Hygiene, held in London, where the preparations were also exhibited.

possible to verify this phenomenon, nor could this fact serve to establish our proposition; for in his case the substance in question was arsenious acid, while the colors used in dyeing are salts of this acid, generally with a cupric base (Scheele's and Schweinfurth's greens), or sulphids of arsenic (realgar, orpiment). And it is obvious that this circumstance is not irrelevant; for arsenic or arsenious acid may be compatible with the life of certain germs while arsenite of copper may be incompatible, and, indeed, would at first sight appear to be so, if we consider the well-known antiseptic action of the salts of this metal.

Hence, in order to prove that tapestries which contain arsenical colors can become poisonous by reason of the transformation of the coloring-matter itself into volatile poisons as a result of the biological activity of the micro-organisms that vegetate in contact with it, it is necessary to prove that these micro organisms can exist with and do transform precisely those colors which are used in tapestries.

My experiments bring a contribution to this interesting question of hygiene and toxicology. The results obtained allow us to determine not merely whether from solid compounds of arsenic and from which of them (arsenious acid, arsenic acid, arsenites, arseniates) it is possible, through the action of microphytes, to develop arseniuretted hydrogen gas or volatile arseno-organic products, but also to determine what species are pre-eminently suited to produce this transformation. In the first place I prepared some potato pulps containing from 0.05 to 0.1 of arsenious anhydride to 1,000 of pulp. These, distributed in several broad Petri capsules, were kept for some days uncovered in a cellar. Soon the growth of moulds and of the common bacteria of the air was very abundant, and at the end of one week a strong smell of garlic began to be perceived, showing that gaseous arsenical emanations were taking place. The cultures were then placed in a large damp chamber, from which, by means of an automatic pump, a continuous current of air was drawn, and this was made to bubble up during about two weeks through a solution of nitrate of silver. A strong reduction of this salt, together with the formation, in Marsh's apparatus, of arsenical rings and spots obtained from the liquid after the elimination of the silver, were the indisputable proofs that the cultures had developed a reducing arsenical gas.

While this was a positive indication of great value in reaching a conclusion, other arsenical pulps in which also germs of many species had been developed gave no evidence of having undergone a similar decomposition. This disparity of results, if on the o[illegible] hand it justifies the discordant [illegible] investigators, must, on [illegible] generic [illegible] conditions [illegible] phere, nutrition, etc., had remained [illegible] began the work of separating the germs and the [illegible] experiments on pure cultures, of which I will treat in detail in my larger work. Of the germs thus isolated some belong to the moulds, others to the schizomycetes; among the former I note penicillium glaucum, aspergillum glaucum, and, above all, as greatly preponderating in the mother culture, mucor mucedo. I would also have endeavored to ascertain exactly the species of other moulds and of the other saprophytes, if I had found them capable of bringing about the important transformations to which I refer, which was not the case.

Nevertheless, each of the germs obtained in pure culture and others also which are most commonly kept in the laboraties (B. radiciforme, B. prodigiosum, B. subtile, yellow sarcina, etc.) were cultivated separately in sterilized potato pulp rendered arsenical by 0.05 grams per 1,000 of arsenic acid. The cultures were kept at the temperature of the surrounding air (20°–27° C.), and in diffused light. After one month of observation I was able to ascertain that the production of arsenical gas (indicated by the characteristic garlic smell) had taken place only in the cultures of mucor mucedo and (in a far less degree) in that of aspergillum glaucum. It was not perceived in any of the other cultures.

In view of these facts, special importance attaches to mucor mucedo, a mould very widely diffused in our atmosphere and capable of reducing remarkable quantities of arsenic acid, as I have been able to make sure by strict chemical researches on the abundant cultures carried on in presence of arsenic anhydride and of alkaline arseniates.

In another series of experiments, intending to follow out the practical direction that I had adopted, I inquired whether this activity of the mucor could he extended to those preparations of arsenic which the art of dyeing utilizes in the coloring of papers and hangings in general. To this end the cultures were carried on in the presence of Scheele's green, Schweinfurth's green, realgar and orpiment.

Without here dilating on the course of each separate experiment and on the method of chemical investigation pursued (a thing which I will do in my forthcoming publication) I will sum up my matter in the following corollaries: —

1. Mucor mucedo tolerates remarkable quantities of arsenic not only without injury, but with advantage to its nutrition, for it grows more vigorously.

2. Many solid compounds of arsenic are, through the biological activity of the fungus that vegetates in contact with them, transformed into gaseous combinations, of which arseniuretted hydrogen is certainly one.

3. This transformation is brought about more or less rapidly, but is constant and lasting in the case of all the oxygen compounds of arsenic, including arsenite of copper, which is the basis of the green arsenical colors used in dyeing. It does not appear to take place in the case of the sulphids of arsenic (realgar, orpiment) although the presence of these in the cultures is not at all detrimental.

4. In given conditions of humidity, temperature and light, arsenical gases may be given off from hangings colored with Scheele's and Schweinfurth's greens, through the vegetation of the mucor (I cannot say yet whether of all the mucorini): hence the danger to those who live in such an atmosphere.

This statement of mine does not, of course, exclude the possibility that poisoning may be caused through inhaling [illegible] fine dust, as William Forster thinks. But it is evident [illegible] only happen as an exception, inasmuch as [illegible] lition of the production of the fine dust is [illegible] of dryness of the walls to which the papers [illegible] we have seen that the poisonous character of arsenical [illegible] gings is generally favored by a certain degree of humidity and can be suspected from a more or less intense smell of garlic in atmospheres which answer to the above-mentioned conditions.

I cannot yet say whether the product of the action of mucor mucedo on the oxygen compounds of arsenic is entirely arseniuretted hydrogen. I have reason to think that it is not. By the action of alkalies I have, in fact, constantly succeeded in setting free a volative substance smelling strongly of garlic from the silver solutions employed to oxidize the assumed AsH_3 developed by the cultures. The gas so obtained, when burned by oxide of copper, furnishes an abundance of CO_2; but it is not possible, thus far, to reach any positive conclusions on this point, nor even to exclude the suspicion that the formation of the CO_2 may depend on the admixture of some other hydrocarbon gas. This point will be made clearer by the special studies that I have undertaken together with Dr. Gorini, for which I am making use of a large culture material.

September, 1891.

A PROBLEM IN PHYSICS.

In *Science* for Nov. 28, 1890, there was a short note on the experiment conducted by Joule, in which air compressed in one cylinder was allowed to expand into an exhausted cylinder. It was shown that the only work done by the compressed air was that of imparting a velocity to its own particles, i.e., it did not expand against a resistance, and hence the chilling produced was slight. This experiment has not received the attention it deserves, and, moreover, it seems to have been entirely misinterpreted. It has been suggested that, while at the first instant on opening communication between the two vessels, there is an expansion into a vacuum and no work done, yet at the very next instant there is air in the previously exhausted cylinder, and there is work done in compressing that. This is a serious fallacy, and lies at the bottom of the misinterpretation. It is very certain that no work against a resistance is done at any moment during the expansion This experiment is so far-reaching in its application, and is so extremely important, that I desire to discuss it a little farther, and I sincerely trust that some one in a suitably-equipped laboratory may be induced to try a few simple experiments in this line.

Tyndall has shown that mere rarefaction is not a source of cold, though this is somewhat of a popular fallacy. Let us take a cylinder with a piston fitted air-tight and moving without friction. Let us consider that there is no loss of heat from the interior nor accession from the outside. Suppose the piston is raised suddenly from bottom to top. A perfect vacuum will be formed; but, as no work has been done below the piston, there will be no cooling effect; all the work and consequent heating would be at the engine, which may communicate with the cylinder, though a hundred feet away. Now, suppose a very thin film of air .001 of an inch thick were at the bottom of the cylinder. When the vacuum was formed this thin film would impart a velocity to its particles in order that they might follow the piston, but this air certainly would not expand against a resistance, and hence the chilling would be exceedingly slight. Suppose the piston should be at a point half-way from top to bottom; when it was raised the air beneath would impart a certain velocity to its particles in following the piston, but here again there would be no expansion against a resistance, and hence the chilling would be slight.

Let us change the conditions slightly. Instead of having the air at atmospheric pressure beneath the piston, as in the last case, let it be at double that pressure. On lifting the piston as before we have taken off the pressure and the air beneath imparts a certain velocity to its particles in following the piston. At the first instant that the piston starts there may be a very slight expansion against a resistance, but that would be momentary. The bulk of the cooling would, as before, be due to the fact that a velocity is imparted to the particles beneath the piston, and, in this case, this velocity would be given to a greater number of particles than before. The cooling would be slightly greater, also, but it would not be due to the loss of heat consequent upon the work of expanding against a resistance.

In order to compute the cooling in such cases as these, a formula has been used which will be found in the *American Meteorological Journal* for November, 1890, p. 339, as follows:

$$\frac{T}{T'} = \left(\frac{p}{p'}\right)^{.291}$$

In this T and T' are the absolute temperatures corresponding to p and p'. It seems to me, however, that this formula is not applicable in this case; for it gives a greater cooling, the less the work that is done. Suppose $\frac{p}{p'} = \frac{3}{4}$, the cooling by the formula would be 38°; if $\frac{p}{p'} = \frac{1}{3}$ the cooling would be 134°; and if $\frac{p}{p'} = 0$, or the expansion was in a vacuum, the cooling would be 490°. Now, by the principles already enunciated, if the expansion took place in a vacuum there would be no expansion against a resistance, and hence there would be no work done except in imparting a certain velocity to the particles. If the formula fails in the last case, it must also fail in all the others. It seems to me that the formula is only intended to be used in cases where there is an expansion against a resistance, and not in the cases here given.

A question has come up recently which may be partly answered by this discussion. It is this: What will be the cooling due to the expansion of gas in a balloon if it should ascend very suddenly to several thousand feet above the earth? Suppose the balloon were instantly put into a perfect vacuum, and the envelope had no resistance; there would be no expansion whatever against a resistance, as we have just seen, and the only work performed would be that of imparting a certain velocity to the particles of gas. As a result the gas would be slightly chilled, but vastly less than if it had expanded against a resistance. Now, if the balloon had been suddenly placed at a point where the pressure was ten inches, or one-third that at the earth, the same principles would apply; the only work done would be in imparting a certain velocity to the particles of gas, and in consequence there would be only a slight chilling.

I should be very glad if some physicist would kindly solve the following problems.

1. Given an exhausted cylinder of certain dimensions, how much would the air be heated if allowed to enter without noise, and until the pressure was the same as that outside?

2. What would be the cooling of a perfect gas in a balloon one-third full, if the pressure on the outside were suddenly reduced from thirty inches to ten inches, the temperature of the outside air remaining constant, the envelope of the balloon being without weight and infinitely flexible?

H. A. HAZEN.

THOMAS WHITTAKER announces a volume by Frederick Saunders (of the Astor Library), entitled "The Story of the Discovery of the New World by Columbus," the same being an abridgment from the latest authorities. It will be an illustrated quarto.

PROFESSOR GEIKIE ON THE GLACIAL PERIOD.

ON Nov. 12 the Edinburgh Geological Society held its anniversary meeting, at which Professor Geikie delivered his presidential address, the subject being, "Supposed Causes of the Glacial Period." The lecturer began by remarking that, although the subject of his address had frequently been canvassed, the last word had not yet been said. The question of the cause or causes of the Ice Age was indeed a hard one, and he was not going to advance any novel speculation or hypothesis on the subject. His object was rather to examine certain views, which, after having been abandoned as untenable, had again been put forward to account for the phenomena of the glacial period. Before attempting to criticise these views it was obviously necessary to ascertain, in the first place, what conclusions had been arrived at with regard to the climatic conditions of glacial or Pleistocene and post-glacial times. We must first have an adequate conception of those conditions before we could estimate the value of any theory of their origin. The climatic conditions of the Pleistocene were then considered. It was shown that at the climax of the so-called glacial period the line of perennial snow in Europe was depressed for not less than 3,500 feet on an average. To bring about such a depression the mean annual temperature must have been lowered 10° or thereabout.

Full consideration of all the glacial phenomena led to the following conclusions: (1) That the cold of the glacial period was a general phenomenon due to some widely-acting cause — a cause sufficient to influence contemporaneously the climate of Europe and North America. (2) That glaciation in our continent increased in intensity from east to west, and from south to north. (3) That where now we have the greatest rainfall, in glacial times the greatest snowfall took place. (4) That in the extreme south of Europe, and in North Africa and South-western Asia, increased rain-precipitation accompanied lowering of temperature — from which it might be inferred that precipitation in glacial times was greater, generally, than it is now.

The remarkable climatic changes of the glacial or Pleistocene period were next considered. It had been proved that the period was interrupted certainly once — perhaps, as many geologists maintained, at least twice — by what were known as inter-glacial conditions. The evidence of this was treated in considerable detail, and the character of the inter-glacial climate was described as being markedly temperate and genial. There could be no doubt whatever that the Pleistocene period was characterized by great oscillations of climate — extremely cold and very genial conditions alternating. The [illegible] likewise that these [illegible]

[illegible] post-glacial times changes in the relative [illegible] sea had taken place.

Any suggested explanation which did not fully account for these various climatic and geographical conditions could not be satisfactory. The view which had met with considerable acceptance, especially by American geologists, was that which attributed the phenomena of glacial times to great movements of the earth's crust. Professor Geikie then proceeded to examine that "earth-movement hypothesis" in detail. He pointed out that in the first place there was not the least evidence of great continental elevations in the northern hemisphere, such as the hypothesis postulated. Next, he showed that even if the desiderated earth-movements were admitted, they would not account for the phenomena. Each of the several applications of this earth-movement hypothesis was criticised in succession, with the result that they were all found inadequate. Neither great elevation of the northern lands alone, nor such elevation accompanied by submergence of the Isthmus of Panama and the deflection of the Gulf Stream, would account for the peculiar conditions of the Ice Age. These changes, no doubt, would profoundly affect the maritime regions of North America and Europe, but they would not reproduce the conditions that obtained at the climax of the Ice Age. Another objection to the earth-movement hypothesis was this, that it did not account for inter-glacial conditions. The advocates of that hypothesis imagined that those conditions would supervene when the highly-elevated northern regions were depressed to their present level, and when the Isthmus of Panama reappeared. But these were precisely the conditions that obtained at the present time, and yet in spite of them the climate was neither so equable nor so genial as that which obtained in inter-glacial times and during the mild stage of the succeeding post-glacial period. The earth-movement hypothesis must be rejected, not only because it was highly improbable that such wonderfully rhythmic elevations and depressions of high northern lands and of the Isthmus of Panama could have taken place, but chiefly because it did not explain the conditions of the glacial period, while it practically ignored those of inter-glacial times.

Professor Geikie next considered the proofs of former submergence which are so abundantly met with in temperate and northern latitudes, and discussed the various views which have been advanced to account for the facts. He concluded his address by considering an objection which had been urged against the physical theory of the glacial period as advocated by the late James Croll. This objection was based on certain estimates of the rate of erosion of river-valleys, the accumulation of alluvial deposits, and so forth, from which it was sought to show that only some 7,000 or 10,000 years had elapsed since the close of the glacial period. The consideration that, if this contention were true, it would bring the close of the Ice Age down to the dawn of civilization in Egypt was rather startling, to say the least. The fact was, however, that all such estimates, however carefully made, were unreliable. Dr. Croll's theory might some day be supplanted by one more satisfactory, but it would not be overturned by niggling and inconclusive measurements of that kind. That theory holds the field in giving the simplest and most consistent interpretation of the climatic vicissitudes of the Pleistocene and post-glacial periods, while it is the only one that throws any light on the very remarkable conditions that obtained during inter-glacial times.

[illegible]TERS TO THE EDITOR.

[illegible]ed to be as brief as possible. The writer's name [illegible]f of good faith.

On req[illegible] hundred copies of the number containing his communication will [illegible]hed free to any correspondent.

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

The Loup Rivers in Nebraska.

PERMIT me to submit through your columns to Professor Hicks the following questions and comments on his acceptable account of the Loup and Platte Rivers in *Science* for Jan. 29 last.

The topographic maps of the region in question are too incomplete for one to learn much from them concerning the present condition of the river valleys; but from general descriptions of that part of the country and from the brief mention by Professor Hicks of the "channels excavated from fifty to two hundred feet in soft tertiary marls" it may be inferred that the streams are little advanced in their present cycle of development. Professor Hicks postulates that at the beginning of the current cycle of river history, the several branches of the Loup River all pursued independent courses to the Platte. The origin of those early courses is not stated; whether they were consequent on the slanting surface of the tertiary marls, or whether they represented the finally adopted positions of old rivers of a previous cycle of growth.

Old rivers, revived by the uplift of the plains into a new cycle of growth are common enough in the western country, and perhaps the Platte and Loup may be of that kind; but, if so, it does not seem possible to explain the present course of the main Loup River as resulting from a recent capture of its several north-west branches. River captures occur during the early maturity of a river system. If the Platte and the Loup are revived from the old stage of a previous cycle, the captures should have taken place in the earlier part of that cycle; and when the river courses had thus become well adjusted, they would be maintained even after uplift and entrance into another cycle, unless distinctly new conditions were thereby introduced. The possibility of this will be considered in a later paragraph.

If the rivers are not now in a second cycle of development, but are in their first cycle, having first taken their course when their region rose from the waters in which its strata were deposited, and having since then done nothing more than cut their shallow trenches in the general unbroken surface of the country, then we must ask whether their initial courses must have been in the arrangement postulated by Professor Hicks, or whether they may not from the beginning have had courses essentially on their present lines of flow. This latter alternative appears to be indicated at the end of Professor Hicks's article, if I read it aright. Assuming that the last great tertiary lake not only submerged the area of the Loup River, but spread its lacustrine sediments over the surface so as to obliterate any channels of earlier date, then on the disappearance of the lake, the rivers would be newly developed on the faint slopes of its deposits. The Platte, bringing down silt in large amount, may have been at that time a constructive river, busied in building up a broad delta like flood-plain, further and further out on the lacustrine deposits as they were revealed. If so, it would turn its lateral tributaries down-stream, and the existing arrangement would be produced without the aid of headwater erosion and capture. Hence, until the process of flood-plain deflection is excluded, it does not seem necessary to include the process of headwater erosion and capture.

But even if it be supposed that the courses of the rivers at the beginning of the present cycle were arranged as postulated by Professor Hicks, and that all of them from the Beaver to the South Loup entered directly into the Platte, it seems impossible to explain their present arrangement by the headwater erosion and piracy of the Loup. The conditions for so systematic a process do not occur in the region under consideration, as will appear from the following analysis.

In the first place, it is important to remember that it is not the river but the little trickling headwater streams on the slopes of the divides that do the capturing in cases of the kind here discussed. The capture of one river by another, or lateral abstraction, as described by Gilbert in his most original examination of this problem in his report on the Henry Mountains is a comparatively rare occurrence, and is not applicable here.

In the second place, capture by little headwaters is most common in regions of tilted rocks of varied hardness, and on the headwaters of "subsequent" streams; that is, streams whose headwater-growth is dependent on the opportunity given by the weathering of some especially weak stratum, along whose strike the stream extends. No such special opportunity has been offered to the Loup River in this region of horizontal beds.

In the third place, as one headwater stream grows, all other adjacent headwaters of the same kind grow at about the same pace. Hence, if the Loup River has so greatly extended itself by headwater erosion, all the other headwater streams should have grown also, and the country thereabouts would be much more dissected by channels than it now is.

Finally, the location of Prairie Creek seems to contradict the supposition that the branches of Loup River ever joined the Platte directly; for, if they had, then Prairie Creek must be, like the supposed extension of the Loup, an example of headwater erosion; and this is not to be thought of in a stream so systematically located between two parallel and larger rivers in a district of horizontal beds.

Taken all together, it does not seem necessary to give any especial emphasis to headwater erosion and capture in this river system. The natural result of excessive deposition along the Platte, as described by Professor Hicks, is alone sufficient to account for the present arrangement of the streams. The growth of the Platte flood-plain may have dammed back some of its tributaries, as certain branches of the Red River in Louisiana are dammed back and converted into shallow lakes; and the present main Loup River would then be developed by lateral overflow along the margin of the flood-plain; but this is quite another process from headwater erosion and capture.

These suggestions are only tentative; for not having seen the region and having no full account of its geological history or of its topography, I can only submit them for criticism.

W. M. DAVIS.

Harvard College, Feb. 10.

Origin of the Frigid Period in the Northern Hemisphere.

IN my letter, published in your issue of Oct. 16, I stated that the independent circulation of the southern ocean waters was the main cause of ice-sheets forming on the lands situated in the high latitudes of the southern hemisphere; and that such currents were caused by the strong westerly winds, which blew the surface waters of the southern ocean constantly around the globe, and thus prevented the tropical surface currents from largely entering its waters. Consequently, through this cause and the constant gathering of ice in the antarctic regions the temperature of the southern latitudes was slowly lowering; and that the growing coldness would continue until the southern ice-sheets filled the Cape Horn channel and prevented the further independent movement of the southern ocean waters. This being accomplished, the westerly winds would blow the surface waters of the sea away from the eastern side of the ice-formed isthmus and the southern lands of South America, and so cause a low sea-level, that would attract the surface waters of the tropical seas far into the southern latitudes, and thus in time furnish heat sufficient to melt the ice from the southern lands. I also stated that an ice period could not be perfected in the northern hemisphere without the assistance of cold derived from a frigid period in the southern hemisphere. The independent circulation of the arctic waters is not complete, owing to land obstructions; but it is able to largely prevent the tropical Gulf Stream waters from entering the higher northern latitudes. The prevailing westerly winds blow the surface waters of the Atlantic away from the eastern shore of North America from Georgia to Labrador; consequently the low sea-level thus caused attracts the high-level tropical waters of the Gulf of Mexico through the Florida channel well into the northern latitudes; and during the same time the westerly winds which blow the surface waters of the Atlantic away from the American coast are also causing a high sea level on the seas abreast north-western Europe, which creates a return current through the Arctic Ocean, passing through the several straits leading into Baffins Bay, and also down the eastern coast of Greenland. Thus the ocean waters of the high northern latitudes maintain a partly independent circulation, which serves to crowd the Gulf Stream away from the higher latitudes, and thus lower the temperature of the arctic regions. Through this exclusion of tropical waters, glaciers have formed on Greenland and other arctic shores; and these glaciers are probably slowly increasing, as every iceberg launched from the frigid lands and floated to the Gulf Stream lowers somewhat the temperature of the north Atlantic, and so causes conditions more favorable for larger accumulations of ice. Still it is probable that a northern ice period could not be perfected by this process alone should the tropical and southern oceans maintain their present temperature. But with the assistance of a frigid period in the southern hemisphere to cool the ocean waters and still further lower the temperature of the Gulf Stream, and also the tropical currents of the oceans, including the great Japanese current, the ice period of both hemispheres would be brought about during the same era. For it is well known to those who have studied the subject that the Gulf Stream derives a large portion of its heat from the south Atlantic; which would not be the case should the waters of the southern hemisphere be chilled by ice. For it appears that all of the south Atlantic islands during frigid times were burdened with glaciers. Even the island of St. Helena, situated in the tropical zone, has the appearance of having been heavily iced during some remote period. Its steep ravines, which deepen as they approach the sea, recall to the southern voyager the ice-worn islands of the higher latitudes. Thus when the temperate regions of both hemispheres were heavily iced the temperature of the tropical seas must have been comparatively low, especially on the eastern sides of the oceans which are swept by the polar currents. Moreover, the sea was much salter than now, on account of a large portion of its waters being absorbed by glaciers. Furthermore, whenever the arctic channels are filled with glaciers the independent circulation of the arctic waters must cease; consequently the Gulf Stream, meeting with less opposing polar currents on its sweep northward, would thus be able to gain a much higher latitude than now. Although its waters at first would be colder than they are to-day; still their superior saltness would add to their ability for dissolving ice wherever they were able to flow. But it appears that the Gulf Stream and other tropical currents of the northern oceans would not be able to subdue the cold accumulated in northern ice-sheets without the assistance of a comparatively warm ocean in the southern hemisphere. The southern seas being so much superior and so widely connected with the northern, the tropical currents of the latter seas would require the assistance of the southern oceans to subdue the cold of a northern ice period, in the same degree that it required their co-operation to bring about the frigid period. The arctic straits, which now facilitate the independent circulation of cold Arctic waters, would, when filled with glaciers, be slow to thaw out, even with the increasing warmth of the arctic regions, on account of being situated to the windward of the warm gulf currents. Therefore, the glaciers that filled their deep channels would be the last great body of ice to melt in the northern regions; and for this reason it is probable that there are fragments of the old ice of the last frigid period still unmelted and now form a portion of the lower shores of the arctic straits. This conclusion is in harmony with reports from Point Barrow which inform us that a stratum of pure ice is found beneath the scanty soil. The low temperature of the waters of the tropical oceans during the perfection of a frigid period must have been very destructive to oceanic life; while such as survived probably found refuge in nearly landlocked equatorial seas, where the waters were largely excluded from the colder ocean, and also freshened by such rivers as emptied into them. Meanwhile, the low temperature of the ocean must have chilled the atmosphere over the land to such a degree as to have caused the destruction of many species of animals.

C. A. M. TABER.

THE abstract under the above title in ...
which I have only just found time to read, proves very interesting to me, and I do not wish in any way to have it inferred that I disbelieve in the influence of electricity, at least indirectly, upon the growth of plants; but it does not seem out of place to call attention to the fact that the comparative rarity of mildew on plants grown above electricity-bearing copper wires in moist soil may be due to the action of the copper salts formed in killing the mildew rather than to electrical action.

The roots of the lettuce in the experiment mentioned at "Garden A" (*Science*, p. 36) are stated to have "grown about the wires, as if there they found the greatest amount of nourishment," etc. This would also be the result from the roots seeking the environment best suited for growth, if the mildew could not thrive about the wires on account of the trace of copper salts which the soil contained.

The use of sprays containing copper salts, in the form of Bordeaux mixture or similar compounds, as a preventive of mildew of grape-vines and other plants is well known, and the control plot, "Garden B," should have been provided with copper wires, exactly as was "Garden A," to make the results of the experiment conclusive. As I have not seen the original article in the Bulletin of the Hatch Experiment Station, from which the abstract in *Science* was taken, it may be the fact that this action of the copper salts upon mildew has been discussed there.

GEORGE DIMMOCK.

Canobie Lake, N.H., Feb. 15.

AMONG THE PUBLISHERS.

E. & F. N. SPON & Co. announce "Roll Turning for Sections in Steel and Iron," by Adam Spencer. The subject of roll-turning is treated from a purely practical point, and for practical men. The drawings are the result of experience, and their value consists in the fact that they are working drawings, that is, drawings of rolls which have passed through the ordeal of actual work. The arrangement of the work is as follows: First, drawing of modern blooming for steel slabs, followed by a pair of billet rolls, then various sections showing the related grooves in cogging, roughing, and finishing rolls, with the position and character of collars required. "A Text-Book of the Science of Brewing," by Edward Ralph Moritz and George Harris Morris. The following extract from the introduction will show its character: "The object of this work is to provide in a convenient and accessible form such knowledge of the processes of brewing and of the materials employed in that industry as is at our disposal; and — so far as we are able — to connect such knowledge with the practice of brewing. We therefore intend it as a text-book in which may be found the results of scientific research together with the practical conclusions which we consider justly deducible from them. We do not pretend that a perusal of our work will enable a novice to brew beer; neither will a study of it convert a purely practical man into a chemist. It is meant, however, to lead the brewer to a better understanding of what we may term the physiology and pathology of brewing, and, by so doing, put at his disposal a means for more efficient control over his operations." "Manual of Instruction in Hard Soldering," by Harvey Rowell. "The Mechanical and Other Properties of Iron and Steel in Connection with Their Chemical Composition," by A. Vosmaer, engineer. The author has gathered together the widely scattered information on this important subject, and gives in brief outline the actual knowledge of the intimate connection that exists between the properties of steel and iron and their chemical composition. The elements — carbon, manganese, silicon, phosphorus, sulphur, copper, chromium, titanium, tungsten, aluminium, nickel, cobalt, arsenic, antimony, zinc, lead, tin, silver, molybdenum, vanadium, potassium, sodium, barium, strontium, calcium, and magnesium — have been considered separately and in the following manner: First, as to the metallurgical behavior of the elements in question; next, to deal with their influence on pig iron, cast iron, wrought iron, and steel; lastly, the special uses made of them, and their occur- ... manufactured objects. The gases, intermolecular, reac- ... have been carefully considered, and analyses ... essemer, basic, and forge pig-irons, spiegel-iron, ... se, ferrosilicons, ferrochromes, ferrotungsten, ferroalumin... st-irons, weld irons. Steel — railway material, structural steel, ordnance material, miscellaneous. With a diagram of silicon in cast iron, and of disappearance of carbon. Also a new edition of "A Practical Treatise upon Warming Buildings by Hot Water."

— Morris Phillips of the *Home Journal* goes abroad every summer for recreation and business. He has kept up that habit for nearly twenty years, besides travelling widely over this country, and as a result of his experiences he has just compiled a note-book of practical hints for tourists entitled "Abroad and at Home," in which he gives incidents of his travels, as well as a complete statistical and detailed account of the cost of trips in Europe and America. It promises to be a valuable guide-book for Americans.

— Henry Holt & Co. will add immediately to Sneath's series of modern Philosophers, volumes extracted from Reid by Dr. Sneath of Yale University; from Spinoza, by Professor Fullerton of the University of Pennsylvania; from Kant, by Professor Watson of Queen's College, Canada; and from Descartes, by Professor Torrey of the University of Vermont. They contemplate adding, in the near future, volumes from Berkeley, Hume, and Hegel.

— "The Basis of the Demand for the Public Regulation of Industries" is the title of a monograph by the Hon. W. D. Dabney, which has recently been published by the American Academy of Political and Social Science. There have been numbers of plans suggested to remedy these evils, the most notable of which is, probably, socialism. Mr. Dabney thinks that this plan will not be adopted, but that government regulation of private business will be tried as remedy for the existing evils of private monopolies.

— The Department of Astronomy of the Brooklyn Institute of Arts and Sciences has just issued a "Hand-book of Astronomy for 1892." The publication is in a new field, and is one that will command general interest and constant use by a very large number of people who have considerable general knowledge of astronomy, and who desire to couple with information gained by reading a practical knowledge from experience and observation. The new publication is designed to aid in the observation of the planets and the constellations every hour when they are visible during the year 1892. The hand book will not only prove interesting to the "amateur" astronomer, but also to those who are working with instruments in observatories. It contains calendars of the eclipses of the sun and moon, of the periods of the inferior planets as morning and evening stars, and of the periods of the greatest brilliancy and elongation of the planets, a selection of the most important occultations of stars, calendars of the positions of the sun, moon, and planets for each day of each month, brief accounts of the opposition of Mars, of the evidence of Venus' rotation, tables showing the motions and positions of Jupiter's satellites, the names and positions of colored stars and double stars, tables of the variable stars of long periods and of short periods, accounts of the zodiacal light and the principal meteoric showers of the year, together with a great deal of valuable information concerning the satellites, the distances of planets and stars, the lengths of the years of the planets and the weights and dimensions of the members of the solar system. A calendar for the seasons and the church calendar are convenient additions. Copies of the hand-book may be purchased by members of the institute, or by others interested in astronomy, at twenty cents per copy, including postage.

CALENDAR OF SOCIETIES.

Philosophical Society, Washington.

Feb. 13.—Gardiner G. Hubbard, The History of the Education of the Deaf; A. W. Greely, Some Peculiarities in the Rainfall of Texas.

Society of Natural History, Boston.

Feb. 17.—George L. Goodale, Illustrations of Vegetation in Ceylon.

Publications received at Editor's Office.

BOWSER, EDWARD A. Elements of Plane and Solid Geometry. 2d ed. Boston, D. C. Heath & Co. 12°. 393 p. $1.35.
BROCKWAY, FRED J. Essentials of Medical Physics. Phila., W. B. Saunders. 12°. 330 p. $1 net.
HARVARD COLLEGE. Annual Reports of the President and Treasurer, 1890-91. Cambridge, The University. 8°, paper. 294 p.
HEMPEL, WALTHER. Methods of Gas Analysis. Trans. from the German by L. M. Dennis. New York, Macmillan & Co. 12°. 401 p. $1.90.
LEFAVEL, CARRICA. Delsartean Physical Culture. New York, Fowler & Wells Co. 12°, paper. 108 p.
MCKILLOP, DUGALD. Shorthand and Typewriting. New York, Fowler & Wells Co. 12°, paper. 123 p.
MUNRO, J. Heroes of the Telegraph. London, Religious Tract Society. 12°, 288 p. $1.40.
MUSEUM OF FINE ARTS. Catalogue of the Print Department. Boston, The Museum. 12°, paper. 98 p.
SCOTT, W. The Lady of the Lake. Ed. by William J. Rolfe. Boston, Houghton, Mifflin & Co. 16°, paper. 273 p. 30 cents.
SCRIBNER'S MAGAZINE. Index to Vols. I-X. New York, Charles Scribner's Sons. 8°. 89 p.
THURSTON, ROBERT H. A Manual of the Steam Engine. Part II. Design, Construction and Operation. New York, John Wiley & Sons. 8°. 957 p.
WHITE, CHARLES E. Number Lessons. Boston, D. C. Heath & Co. 12°. 201 p. 45 cents.

Business Department.

Intending investors and others interested in real estate matters in the rapidly devel- ... f Washington are invited to 'eading of the advertisement ;ton Fire Clay Company on his number. Mr. C. Cooper ;ident, will show photographs of the property advertised. ersonally acquainted with all many of the stockholders of id can vouch for the entire truthfulness of any state- make.

Wants.

Any person seeking a position for which he is qualified by his scientific attainments, or any person seeking some one to fill a position of this character, be it that of a teacher of science, chemist, draughtsman, or what not, may have the 'Want' inserted under this head FREE OF COST, *if he satisfies the publisher of the suitable character of his application. Any person seeking information on any scientific question, the address of any scientific man, or who can in any way use this column for a purpose consonant with the nature of the paper, is cordially invited to do so.*

A PROFESSORSHIP in Chemistry is wanted by one who has had five years' experience in that capacity. Would prefer to give instruction by lectures and experiments rather than by text-book methods. Would like a position in a college or university where there is a good student's laboratory. Special points of strength claimed are: (1) Thorough control of a class and good order during lectures and recitations. (2) Accuracy in experimenting with chemicals and skill in the manipulation of chemical apparatus. The permission of several distinguished educators has been given to refer to them if required. Would not care to accept a position paying less than $1,500. Address B. E., care of *Science*, 874 Broadway, New York.

ADDRESS WANTED.—Will some one please send the address of the Secretary of the American Philological Society. Also that of Herbert Spencer. "ADDISON," Room 84, 164 Madison St., Chicago, Ill.

ADDRESSES of Old Book Dealers wanted.—Wishing to obtain a number of old books out of print, I very much desire the addresses or catalogues of rare second-hand book dealers. If there is a directory or list of such dealers I should like to obtain possession of one. W. A. BLAKELY, Chicago, Ill.

WANTED.—Books on the Magic Lantern. Will exchange, "How the Farm Pays," by Cozier and Henderson; "Culture of Farm Crops," by Stewart; "American Agriculturist," 1890 and 1891. I. SLEE ATKINSON, 43 Wallace St., Orange, N. J.

WANTED.—(1) A white man versed in wood and iron working, able to work from specifications and plans, suited for an instructor of boys; his business to have charge of shops of school, outline and direct the work for foremen and students; salary to be $1,000 per annum (nine months). (2) A man (black preferred) to teach the colored, iron working and forging, subordinate to the preceding; salary, $720. (3) A man (white) competent to take classes in engineering (assistant's position), but with the ability to perform any of the work required in any of the ordinary engineering courses of our universities; salary from $1,000 to $1,500. A. H. BEALS, Milledgeville, Ga.

BOOKS: How to Exchange them for others. Send a postal to the SCIENCE exchange column (insertion free), stating briefly what you want to exchange. SCIENCE, 874 Broadway, New York.

Exchanges.

[Free of charge to all, if of satisfactory character. Address N. D. C. Hodges, 874 Broadway, New York.]

To exchange; Experiment Station bulletins and reports for bulletins and reports not in my file. I will send list of what I have for exchange. P. H. ROLFS, Lake City, Florida.

Finished specimens of all colors of Vermont marble for fine fossils or crystals. Will be given only for valuable specimens because of the cost of polishing. GEO. W. PERRY, State Geologist, Rutland, Vt.

For exchange.—Three copies of "American State Papers Bearing on Sunday Legislation," 1891, $2.50, new and unused, for "The Sabbath," by Harmon Kingsbury, 1840; "The Sabbath," by A. A. Phelps, 1842; "History of the Institution of the Sabbath Day, Its Uses and Abuses," by W. L. Fisher, 1859; "Humorous Phases of the Law," by Irving Browne; or other works amounting to value of books exchanged, on the question of governmental legislation in reference to religion, personal liberty, etc. If preferred, I will sell "American State Papers," and buy other books on the subject. WILLIAM ADDISON BLAKELY, Chicago, Ill.

Wanted, in exchange for the following works, any standard works on Surgery and on Diseases of Children: Wilson's "American Ornithology," 3 vols.; Coues' "Birds of the Northwest" and "Birds of the Colorado Valley," 2 vols.; Minot's "Land and Game Birds of New England;" Samuels' "Our Northern and Eastern Birds;" all the Reports on the Birds of the Pacific R. R. Survey, bound in 2 vols., morocco; and a complete set of the Reports of the Arkansas Geological Survey. Please give editions and dates in corresponding. R. ELLSWORTH CALL, High School, Des Moines, Iowa.

Wanted to buy or exchange a copy of Holbrook's North American Herpetology, by John Edwards. 5 vols. Philadelphia, 1842. G. BAUR, Clark University, Worcester, Mass.

For sale or exchange, LeConte, "Geology;" Quain, "Anatomy," 2 vols; Foster, "Physiology," Eng. edition; Shepard, Appleton, Elliott, and Stern, "Chemistry;" Jordan, "Manual of Vertebrates;" "International Scientists' Directory;" Vol. I. *Journal of Morphology;* Balfour, "Embryology," 2 vols.; Leidy, "Rhizopods;" *Science*, 18 vols., unbound. C. T. McCLINTOCK, Lexington, Ky.

To exchange Wright's "Ice Age in North America" and Le Conte's "Elements of Geology" (Copyright 1882) for "Darwinism," by A. R. Wallace, "Origin of Species," by Darwin, "Descent of Man," by Darwin, "Man's Place in Nature," Huxley, "Mental Evolution in Animals," by Romanes, "Pre-Adamites," by Winchell. No books wanted except latest editions, and books in good condition. C. S. Brown, Jr., Vanderbilt University, Nashville, Tenn.

For Sale or Exchange for books a complete private chemical laboratory outfit. Includes large Becker balance (200g to 1-10mg), platinum dishes and crucibles, agate motors, glass-blowing apparatus, etc. For sale in part or whole. Also complete file of *Silliman's Journal*, 1862-1885 (62-71 bound); Smithsonian Reports, 1854-1883; U. S. Coast Survey. 1854-1869. Full particulars to enquirers. F. GARDINER, JR., Pomfret, Conn.

—The *Chautauquan* for March presents the following among other articles: Growth and Distribution of Population in the United States, by General Francis A. Walker; Physical Culture, II., by J. M. Buckley; National Agencies for Scientific Research, V., by Major J. W. Powell; Ocean Perils, by Felix L. Oswald, M.D.; The Ownership of Literary Property, by George Haven Putnam; Lyceum Attractions of To-day, by W. H. Stenger; The National Library and its Librarian, by Fannie C. W. Barbour; Words to the Deaf, by Katherine Armstrong; What Women Owe to Inventions, by Margaret N. Wishard.

—John Wiley & Sons have in preparation a work on timber and metallic structures entitled "Theory and Practice in the Designing of Modern Framed Structures." This book is written jointly by Professor J. B. Johnson, author of "Theory and Practice of Surveying," and professor of civil engineering in Washington University, St. Louis, by Mr. C. W. Bryan, designing engineer of the Edge Moor Bridge Works, Wilmington, Del., and by F. E. Turneaure, instructor in civil engineering in Washington University. It will describe in great detail the most modern and approved styles of structures and methods of analysis, giving only a historical review of obsolete forms of trusses and abandoned analytical methods. It will treat not only of bridges and roofs but also of trestles, viaducts, stand-pipes, elevated tanks, and steel skeletons for high buildings. It will be adapted to serve both as a text-book in the higher engineering schools and as a hand-book for the designing engineer.

—Houghton, Mifflin, & Co. have just ready "Mark Hopkins," illustrious as president of Williams College for thirty-six years, and as president of the American Board of Commissioners for Foreign Missions for thirty years, by Professor Franklin Carter, present president of Williams College; also a new work, by Dr. Josiah Royce, entitled "The Spirit of Modern Philosophy."

SCIENCE

A WEEKLY NEWSPAPER OF ALL THE ARTS AND SCIENCES.

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CONTENTS.

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SCIENCE

NEW YORK, FEBRUARY 26, 1892.

RECENT WORK ON PLANT DISEASES BY THE DEPARTMENT OF AGRICULTURE.

FARMERS' BULLETIN No. 5, on "Treatment of Smuts of Oats and Wheat," is in press and will shortly be issued by the Department of Agriculture. It has been written by W. T. Swingle, a special agent of the Division of Vegetable Pathology, who has studied the subject for three or four years past. After describiug the loose smut of oats and the stinking smuts of wheat, there is given a statement of the loss resulting from the diseases. That from the former is estimated at from 5 to 10 per cent of the crop, but from the latter as much as 40 to 50 per cent. The author calculates that if the oats had been treated as now recommended, there would have been saved to the country between 1880 and 1890 over $162,000,000.

The treatment, however, now used to prevent smut was only discovered in 1887, and it is known as the Jensen hot-water treatment. The process given is to immerse the seed to be treated, placed previously in a wire-netted receptacle or some other perforated vessel so that the water percolates freely, in a kettle of water at a temperature of 110° F., until all the grains are thoroughly wetted. Then plunge them into a second vessel, with the water heated to 132½°, for fifteen minutes, dipping up and down and twirling around so that the hot water comes into contact with all the grains. They are then taken out and dried thoroughly if not sown immediately, but only partially dried if the grain is not to be kept. The treatment for wheat is similar, but the water should be heated to a temperature of 143½°, and the seed immersed only five minutes.

Potassium sulphide, in the proportions of 1 pound to 24 gallons of water, in which the oats are soaked for 24 hours, is also recommended. If made of double strength, an immersion of 12 hours will be sufficient. For wheat a solution of 1 pound of copper sulphate to 24 gallons of water, soaking 12 hours, and then leaving for 5 or 10 minutes in lime-water made by slaking 1 pound of lime in 10 gallons of water, is considered beneficial in preventing stinking smut of wheat.

This bulletin is directly in the line of work now being actively pursued by the Department of Agriculture, and especially by the Division of Vegetable Pathology. It is the business of this division to investigate the diseases of plants due to fungi, and the work of the past year has been of such a practical character, that in the treatment of one disease alone, black-rot of the grape, it is calculated to have saved grape-growers between $75,000 and $100,000, or about four times the total amount of the annual appropriation for the whole division. When this is remembered, and it is known that many other diseases, such as pear leaf-bright, apple scab, potato rot and blight, powdery mildew of the grape and apple, celery blight, etc., have been studied, and remedies or preventives suggested, the valuable character of the work of the division will be readily seen.

During 1891 experiments were conducted on an extensive scale in western New York in the treatment of nursery stock, several million trees having been treated with success in preventing the attacks of fungi. The practical character of the work of the division is further shown in its action during the "grape scare" in New York City. Last fall the Board of Health of the city seized a small consignment of grapes that had been sprayed with a solution containing a small amount of copper. This solution, known as Bordeaux mixture, had been found effectual in preventing black-rot, and had been extensively used. When the graves were seized, exaggerated reports of the bad effects resulting from the use of sprayed fruit were telegraphed far and wide, and the grape market was demoralized. As soon as the situation became known in Washington, the chief of the division was sent to New York, and by explaining to the Board of Health the harmlessness of the small amount of copper that properly sprayed grapes received, he allayed the excitement and the market was restored to its previous condition. There is no doubt but that this prompt action saved thousands of dollars to the vineyardists of New York and other States. The amount of copper which the sprayed grapes contain has been shown to be less than that normally present in many of the articles of ordinary diet.

Besides the bulletin mentioned in the first part of this article there is ready for the press a report on the virulent vine disease of California, which, appearing near Anaheim about 1884 or 1885, has caused widespread destruction of vines in that vicinity. The causes and cure or prevention of this disease are at present unknown, but are being diligently studied with the hope of finding some remedy. There is also in preparation a report upon the work done by the division during the past year, and this will be issued as soon as circumstances permit. Finally, a new number of the *Journal of Mycology* will be issued soon, which will contain valuable and interesting matter. One article is upon an Almond Disease in California, caused by a fungus attacking the leaves and making them drop prematurely. This article is illustrated by four plates, and is followed by a statement of how to prevent the attack of the fungus. Another article is on Club-Root, a disease caused by a fungus which attacks the roots of cabbages, turnips, etc. This is also illustrated. Other articles deal with descriptions of new species, or notes upon old ones. An important portion of the number will be the "Index to Literature." This covers the whole subject of diseases of plants, and embraces the literature of the entire world. It is the intention to give a brief notice or abstract of the contents of each paper. These notices are arranged under subjects, so that it will be possible for one interested in any special subject to find the articles treating of that subject without wading through the entire index. There will be over three hundred articles indexed in this single index, and an earnest endeavor will be made to have it as complete as possible.

JOSEPH F. JAMES, M.SC.

Washington, D.C, Feb. 17.

A NEW COLOR SCHEME.

Every student of botany, ornithology, or entomology, has found the lack of any well-defined standard or credited nomenclature of color a prolific source of trial and perplexity, while to the common eye there is nothing but confusion in our present methods of designating color. No stronger proof of this is needed than some of the terms used to designate fashionable colors, such as "crushed strawberry," "ashes of roses," "elephant's breath," etc. What more absurd terms could one easily choose to express an intelligible conception. This is no doubt largely due to the fact that there has been no channel through which to introduce reform. It must be done through those who deal largely in material where there is frequent occasion to designate colors. The naturalist might fix his standards and nomenclature, as he has already done, but the great world would go on just the same, ignoring him and his little clique till the end of time. The physicist may speculate and dogmatize on the theories of color and reach admirable results, but find himself unable to alter the nomenclature of either commerce or every-day life. Manufacturers, who depend upon the demands of trade, must provide what is called for in the market or have their wares left on their hands, and find themselves the losers thereby. The ever changing fashions seem almost to necessitate the use of new and striking names for things even themselves very ancient. These facts leave little ground for hope that any reform can be expected through the ordinary channels of trade.

It is very refreshing, however, to find now and then a man who, in the midst of commercial competition, is willing to give some thought to the propagation of scientific truth. About twelve or thirteen years since Mr. Milton Bradley of Springfield, Mass., who was engaged in the manufacture of kindergarten supplies, conceived the idea of reducing the making of colored papers to some method which would be practical and at the same time sufficiently accurate to be of value as a means of education. At my suggestion the solar spectrum was taken as the basis of his scheme. The difficulty of reproducing the beautiful colors of the spectrum in pigments seemed at first almost insurmountable, but after long experiment, and the expenditure of much time and money, it was found that colors could be produced in papers which fairly approximate the colors of the spectrum.

The scheme adopted by Mr. Bradley contains six standard colors, viz., red, orange, yellow, green, blue, violet — colors generally recognized and readily distinguished in the solar spectrum. It was found that, combining these colors in the Maxwell disks, a neutral grey could be produced, while with a less number this would be impossible. These, together with a white and a black, constitute the basis of the system. If a disk of one of these standard colors be placed upon the wheel together with a white disk, and the proportion of the exposed surfaces of the two disks varied, a number of modifications of the color varying from the standard to pure white will be obtained. These are called tints. Similar combinations of the standards with black produce what are called shades. Each of the standard colors is treated in the same manner. If a disk a little larger than the regular size with a border graduated into 100 degrees, be placed behind the disks to be used in combination, the exact proportion of each disk can be determined. The first letter of each color is used as its symbol, except that for black N. (niger) is used to avoid the repetition of B. If we combine red and black in equal proportions, thus, R.50 N.50, we shall get a shade of red. We may designate this as red shade No. 1. In a similar way each color would be treated. Each may be combined with other colors and the symbols written in a similar manner. Red and orange, the former predominating, would be called orange red, written O.R. A given combination of these two colors would be expressed by O.25 R.75. This would in turn have its tints and shades. When the proportions are not needed, R.T., R.S., O.Y., G.B.S., would very simply indicate red tint, red shade, orange yellow, green blue shade, respectively. Thus simply is the eye trained to discern the components of each hue by the aid of the symbols. The simplicity of the system and surpassing beauty and number of hues obtained is striking.

A large series of papers manufactured according to this scheme is already used in kindergartens and many primary schools. One manufacturing firm proposes to use the wheel and disks in connection with the coloring of textile fabrics. The disks are also used in ordering new colors from the factory, where a duplicate set of the disks is used to translate the symbol into the visible effect desired. Architects and artisans find the scheme convenient in studying the effect of adjacent colors. Indeed, a system of color harmonies has already been partly elaborated with this scheme as its basis.

The next most important step is for the physicists to establish the location of these six colors within certain limits of wave-lengths, and then secure some material in which the standard color can be permanently preserved for comparison. What a saving of confusion in the use of color names is thus gained we are hardly able to realize. The following quotation from a pamphlet issued by the Milton Bradley Company, explaining the scheme, will indicate one of the many applications of the scheme:—

"A careful study of these representative combinations of disks will suggest numerous possibilities not mentioned here. One of these is the giving of exact and definite names in the terms of our standards to the common colors. For example, it is well known that under the same name different manufacturers make pigments varying very largely in color.

"If, having a small tablet of millboard or other suitable substance painted with an even coat of Windsor & Newton's light red tube color, we match the color with our disks, we find the nomenclature to be O.24, N.76; while a German color with the same name gives O.18, N.82, both being shades of orange, although the German color is much darker than the other.

"The same test with two tubes of cinnabar green gives Windsor & Newton's, Y.14, G.11½, N.74½; the German, Y.12½, G.11, W.2, N.74½, the first being a shade of a green yellow, and the second a broken green yellow; the shade contains black with the yellow and green, and the broken color has both black and white.

"In Windsor & Newton's chrome yellow we have O.29, Y.71; the German, O.35, Y.45, N.20; the first a pure orange yellow; and the second a shade of a much more orange yellow.

"The following analysis of some other common colors may be interesting, as showing how simple and practical our nomenclature is: —

"Chinese vermillion — R.77, O.23.
"Yellow ochre — O.24, Y.24, N.52.
"Indian red — R.7½, O.17½, N.75.
"Emerald green — G.63, B.14½, N.22½.
"Deep cadmium yellow — R.5½, O.67, Y.20.
"Chrome green, No. 2 — G.16½, Y.5, N.78½."

J. H. Pillsbury.

Smith College, Feb. 18.

THE DECLINE OF SWAGGER.[1]

WE shall not, we hope, be accused of knocking another nail into the coffin of Respectability if we venture to point to the decline of swagger as one of the signs of the times. No doubt the change is somewhat recent, and the transition hardly complete. But we may take it as established that, for the moment at any rate, swagger is not the fashion. No doubt the consciousness of personal merit and possible superiority is as strong in human nature as ever. But most people are contented to acquiesce in the knowledge of the fact, and are willing not only to forego the particular form of its expression which is known as "swagger," but even to live without expressing it visibly at all. The most obvious and disagreeable form of self-assertion, which consists in making other people conscious of their inferiority by intensely unpleasant and supercilious behavior, has, of course, been dead and done with as a social claim for half a generation. High-born and wealthy heroes of the old novelists, who were too great to speak at the breakfast-table, and "turned to fling a morsel to their dogs with an air of high-bred nonchalance," exist no longer in fiction, and very rarely in life. Mr. Grandcourt was perhaps the last of them. But swagger in its minor and more amusing manifestations is also dying; and though it is premature to write its epitaph, we may call attention to some of the symptoms of its decay. One of the later forms of swagger, much affected by men of the bachelor leisured class, and especially by the much-abused "lotus-eaters" of club-land, was the *nil admirari* attitude. It had quite a vogue for a time, and in addition to conveying an impression of superiority, saved a great deal of trouble. Older men who had seen life were spared the effort of hearing about it again; and young men who had not were able to convey the impression that they had. This form of swagger had positive merits in a negative form. It is still in use as a weapon against a bore, but as a fashionable cult it exists no longer. It is as dead as wigs and powder.

Soldiers, for instance, are now among the quietest of men, not marked off by any mannerisms of dress or demeanor from other well-bred and agreeable gentlemen. No doubt "competition," in place of purchase, has somewhat reduced the number of men of private fortune who hold her Majesty's commission. But even if that consideration could account for the difference, the change is only partial, and the cavalry is still a service mainly officered by men of means. But the heavy "plunger" swagger which once distinguished these gentlemen in their relations to men in less fashionable professions has almost disappeared, except among a few of the very old stagers who cannot unlearn, and the very young ones who have not learned better. Some evidence of the change of manner among soldiers may be found in their increased popularity in general society—among men, that is; for it may be doubted whether the other sex quite shares the satisfaction with which men hail the absence of the military swagger. Sir Thomas de Boots no longer comes in "scowling round the room according to his fashion, and a face which is kind enough to assume an expression which seems to ask, 'And who the devil are you, sir?' as clearly as if the General had himself given utterance to the words." On the contrary, he as a rule makes himself exceedingly pleasant, claims no more attention than is spontaneously rendered to him and his known position in the service, and perhaps forgets to fill his glass while engaged in explaining the theory of the *Kriegspiel* to some inquiring youngster.

[1] London Spectator.

Among minor types we may notice that the scholastic swaggerer whom Thackeray denounced among his university snobs has almost, if not quite, disappeared — partly, perhaps, because scholars are now turned out by the hundred instead of by half-dozens, and their monopoly of a certain kind of knowledge is broken; partly because good taste has grown with knowledge, and scholars may also be men of the world. No doubt, with wisdom cometh understanding; but we wish that those men of the age, the "scientific gentlemen" — scholars are rather down in the world just now — could discern the signs of the times in the matter of swagger. At present they possess, with Jews, mushroom financiers, and very successful tradesmen — the Egerton Bompuses of the day — almost a monopoly of the amount of obvious and positive swagger visible. Whether in public controversy or social intercourse, the scientific person sometimes swaggers with unquenchable energy. In those public discussions which lend such piquancy to the columns of the *Times* in the dull season, he still delights to pounce from his hygienic mountain home on some wretched disputant, and show him up as an ass — and a fraudulent ass — in that strong native Saxon, undimmed by "pedantry" and "silly compliance," which less gifted minds call education and courtesy. And if some weak controversialist writes in the victim's defence to say that, after all, what was in the poor man's mind was perhaps so-and-so, how promptly some other scientific person takes up the cudgels and knocks the nonsense out of him! These sterling qualities have so endeared him to the social circle that the mere reference to a "professor" — an honorable title which seems to be monopolized by the expounders of natural science — is usually enough to drive any number of plain men half frantic. No doubt society has itself to blame in a measure for the tyranny of the professors. It overestimated the value of the "facts" which they knew, before they could be weighed and compared with other forms of information. The modesty of Faraday, with his mild formula, "It may be so," and of Darwin — who was a country squire as well as a biologist — are forgotten in the swagger of the new men. But swagger, though not confined to parvenus, is, after all, the parvenu's besetting temptation; and the "scientific men" are the parvenus of knowledge.

Swagger, nowadays, is mainly limited to people living in little worlds of their own. Contact with the big world and realities rubs it away. Petty country squires, buried in remote neighborhoods, often give themselves airs most comical to behold by those capable of comparing what they are with what they claim to be. The bumptious scientific gentlemen who have made their class a byword, the bloated financier, and the overgrown shop-keeper, even when success is attained, are only on the verge of the world where their training should begin. Their time has been otherwise, and, let us hope, more profitably, occupied; and if they do not reform, their children probably will, and will do their best to reclaim their erring parents. For there is no lesson which that increasingly wise young person, the young man on his promotion, has laid more to heart than that "swagger," or, as he prefers to call it, "side," does not pay; and whatever his private opinion as to his own merits, he distinguishes very clearly between the swagger which does not pay and judicous self-advertisement which does. Moreover, being an educated young person with some claims to good taste, he is discriminating even in the means he takes to advertise himself, having recourse only as a last and doubtful resource to self-assertion or eccentricities of dress and manner.

MARINE ENGINEERING AND NAVAL ARCHITECTURE AT CORNELL.

In October, 1890, the Board of Trustees of Cornell University authorized the director of Sibley College, Dr. R. H. Thurston, to organize a graduate school of marine engineering and naval architecture as a department of that college. Owing to the difficulty of obtaining suitable officers, no appointments were made until September, 1891, when Professor W. F. Durand, late of the Engineer Corps of the United States Navy, was appointed principal. This appointment was followed some months later by that of Professor G. R. McDermott, late with J. & G. Thompson, Clydebank, as assistant in naval architecture.

The object of the school is to provide courses, both practical and theoretical, where any one possessed of a good general engineering knowledge may learn of the applications of engineering and science to the design, building, powering, and propulsion of vessels of all types. The courses as at present offered cover two years, and are designed to thoroughly ground the student in the fundamental principles of the science, and to give him a large amount of practical application by the study and analysis of existing designs, and the subsequent preparation of designs of an original character.

The present year is considered as formative, but regular courses are given in marine engineering, naval architecture, and shipbuilding, the work being taken by from twelve to fifteen students. During the coming spring and summer Professor Durand will visit the schools of similar kind in Europe, studying their organization, methods, equipment, and objects, in order that the school may have the advantage, as far as the differing conditions will admit, of the results of experience in these older schools.

The work at the university may be supplemented by an annual excursion or inspection tour of from ten days to two weeks, in which the leading ship-yards and marine-engine shops of the Atlantic coast are visited, in company with one of the teachers. By means of these visits the student is brought into immediate contact with the actual fulfilment of the various problems which he has been studying from lecture, text book, and drawing-board. The practical methods of work are examined, notes and sketches are taken, and a written report on the trip is prepared and submitted.

In the arrangement of the subjects and in the division of time for the professional work, it is intended to give sufficient time to theory and general principles to furnish a good general grasp of the subject, such theoretical work being always illustrated and impressed by applications to practice, and supplemented by a large amount of work more purely practical in character.

The objects to be kept in view are considered as two-fold. First, the power to deal intelligently with the actual problems of ship and power design and construction as they present themselves in practice. Second, the fostering and development of that originality of thought which, under proper control and with other gifts, may form the suggestiveness of mind characteristic of those qualified to aid in the continual advancement of engineering and scientific work.

Of special equipment the school is provided with the following: Several hundred photographs and drawings, both general and detail, illustrative of marine construction of all forms. A number of half-breadth models of ships, including some of the more noted Atlantic liners. A complete set of Copenhagen ship curves, with battens, special drawing-boards, and all appliances for ship drawing. An Amsler integrator of the latest type Large additions are being made to the books and other professional literature already in the library, and no pains will be spared to make the library equipment as complete as possible in every form of literature relating to marine engineering and naval architecture. The equipment of the general mechanical laboratory, unexcelled in extent by that of any laboratory in the world, is also available for use by the student, and every related department of the university will offer its best facilities for such work as students in the School of Marine Engineering and Naval Architecture may find desirable.

NOTES AND NEWS.

Professor Cragin, in charge of the Department of Geology and Palæontology in Colorado College, Colorado Springs, is now absent on leave in the service of the Geological Survey of Texas, under State Geologist Dumble. His work will be largely palæontological. His headquarters and address are Austin, Texas.

— The committee on the memorial to be erected to the memory of the late G. A. Hirn, the eminent engineer and physicist, composed of selected representative men in his department of research throughout the world, has just issued, through its president, M. G. Kern, a circular inviting contributions from all who desire to aid in this work, and who appreciate the contributions made to science and to the arts by that great man. M. Hirn died at Colmar, Alsace, January, 1890, and this committee was very soon afterward formed for this especial purpose. Its plan is to erect at Colmar a monument, to be designed by his friend, M. Bartholdi, a statue in bronze, the pedestal to be inscribed with the simple words:

G. A. Hirn,
1815–1890.

It is expected that the monument will be erected mainly by contributions from the citizens of his native town; but the voluntary contributions of friends all over the world will be gladly received as tokens of the respect and affection which the man and his work have earned for him. Such funds as may be given for this object may be sent directly to the treasurer, M. Georges Baer, Colmar, and to any member of the committee in this country. Professors Asaph Hall, L. S. Holden, W. B Taylor, and Dr. Thurston will gladly take charge of them and forward with suitable acknowledgments to the donors.

— At the August meeting, in Washington, of the Society for the Promotion of Agricultural Science, a paper was presented on "Eastern and Western Weeds," by Byron D. Halsted, New Brunswick. N.J. His remarks were founded upon the reports of a large number of botanists and crop growers throughout the United States, received in response to letters sent to them or questions asked through the public press. Having lived for four years in Iowa, and being now a resident of New Jersey, the weeds of these two States have received personal consideration, and therefore these widely separated States will furnish a basis for a comparison of the weeds of the East and the West, not being unmindful of the fact that Iowa represents the central part of our continent, while the West, strictly speaking, reaches beyond the Sierras. The New Jersey list can be made up from the one for Iowa by omitting seventy-five of the native prairie plants mostly perennials, and adding forty-three, a large percentage of which are annuals. The only single weed of the first rank stricken from the Iowa list in adapting it for New Jersey is a species of pig weed, but even this within the last year has been found within the latter State. On the other hand there are several first-class weeds that are added in the adoption of the western list to the East. Of such, for example, are: a pepper grass, the wild radish, two kinds of cocklebur, feverfew, wild onion, wild leek, nut-grass, Bermuda grass, and a kind of chess, or a total of ten of the worst weeds. That which is true of New Jersey and Iowa likewise holds good for the whole East compared with the whole West. The East is overrun with a larger number of the most aggressive weeds; weeds that assert their ability to resist the forces of the cultivator and plant their banners upon the tilled ground, likewise annual weeds that stock the soil with a multitude of seeds, ready to spring into life whenever an opportunity offers. Some species of weeds are found everywhere, from Maine to California, as Chenopodium album, Amarantus retroflexus, Xanthium Canadense, Plantago lanceolata, Capsella Bursa-pastoris, and Portulaca oleracea. There are others prominent on the Pacific Coast and not elsewhere, as the Hordeum murinum, Silybum Marianum, and Malva borealis. Likewise there are weeds peculiar to the Rocky Mountain region, as the Iva axillaris, Franseria tomentosa, while on the prairies, especially in Kansas and Nebraska, the following head the list: Cenchrus tribuloides, Asclepias Syriaca, Solanum rostratum, and Helianthus annuus. In the middle prairie States it is mostly the members of the sunflower family, as the ragweeds and cockleburs, that prevail. Coming into the central States the list is led by Canada thistle, quackgrass, docks, daisy, chess, plantain, and purslane. If to this list we add wild carrot, onion, and parsnip, and the like old foreign enemies, we have the extensive catalogue of these plant pests that prey upon the lands of New England. Of the weeds of the South as compared with those of the North it has not been the purpose here to speak, nor of the migration of weeds.

— At a meeting of the Chemical Society of Washington, Feb. 11, W. H. Krug read a paper on "The Behavior of Sugar Solutions with Acetone." Acetone and water are miscible in all proportions at ordinary temperatures. If a mixture is prepared containing more than ten per cent acetone, and sugar added in small quantities dissolving after each addition, a point will be reached where the further addition of sugar causes a separation of acetone. We can continue adding sugar until the water is saturated. It will then still contain a small percentage of acetone. At 25° C. this is approximately 9.5 per cent. On account of the highly viscous nature of a saturated sugar solution it is impossible to determine this figure accurately. It is thus necessary to reverse the problem, determining the solubility of acetone in sugar solutions of varying strength. Sucrose is absolutely insoluble in pure acetone. The acetone used boiled at 57.5° C. The following method was used for determining the solubility of acetone in sugar solutions. Twenty-five grams of a sugar solution of known strength were rapidly weighed into a flask, a small thermometer inserted and the flask closed with a rubber stopper. The whole apparatus was then weighed. It was brought to the required temperature and acetone added in small quantities from a burette, the flask being stoppered and shaken before each addition. The flask and contents were carefully kept at the same temperature. As soon as the saturation point was reached the next drop of acetone produced a milkiness, which on standing resolved itself into minute drops of acetone. The flask was then weighed again, and the weight of acetone added determined in this manner. The results were very satisfactory. The solubility of acetone in sugar solutions decreases as we raise the temperature. The curves of solubility were determined for three temperatures, 20°, 25°, and 30° C. From 40 to 50 per cent sugar they are practically parallel, and from 50 per cent they approach each other. It seems probable that they meet at 75 per cent.

Table of Solubility.

One hundred grams sugar solution dissolve per cent acetone at —

Per Cent Sugar.	20° C.	25° C.	30° C.
40	96 44	92.76	89 84
45	71.92	68.81	65 72
50	50.83	48.13	45.85
55	35.78	33.81	32.54
60	25.17	24.18	23.35
65	18.33	17 68	17.09
70	13.22	12.82	12.53

— According to a report recently published in Germany, there were, in 1889, 5,260 workmen killed in accidents, and 35,392 seriously injured. These losses do not vary much from one year to another. *Nature* compares the figures with those of the killed and wounded at Gravelotte — one of the most murderous battles in this century — which were 4,449 and 20,977. The industries furnishing most accidents were as follows, in descending order: mines, railways, quarries, subterranean works, building, breweries. All industries are arranged in 64 corporations, and it is estimated that more than 4 500,000 of work-people are insured. Wounds and fractures are the most usual form of injury, and the duration of treatment tends to increase every year, by virtue of a law which makes an allowance when incapacity for work exceeds three weeks (this was based on the observation that fractures were generally healed in three weeks). Since this law was introduced the treatment of fractures has taken longer. There are always more accidents in winter than in summer, and on Mondays and Saturdays than on other days. Also, there are twice as many accidents from 9 A.M. to noon, and from 3 to 6 P.M., than from 6 to 9 A.M., and from noon to 3 P.M. Better light in summer, and fatigue towards the end of each half-day of six hours, are supposed to explain some of these variations.

— In the February number of *Nature Notes*, Mr. Robert Morley vouches for the accuracy of a story which seems to indicate the possibility of very tender feeling in monkeys. A friend of Mr Morley's, a native of India, was sitting in his garden, when a loud chattering announced the arrival of a large party of monkeys, who forthwith proceeded to make a meal off his fruits. Fearing the loss of his entire crop, he fetched his fowling-piece, and, to frighten them away, fired it off, as he thought, over the heads of the chattering crew. They all fled away, but he noticed, left behind upon a bough, what looked like one fallen asleep with its head resting upon its arms. As it did not move, he sent a servant up the tree, who found that it was quite dead, having been shot through the heart. He had it fetched down and buried beneath the tree; and on the morrow he saw, sitting upon the little mound, the mate of the dead monkey. It remained there for several days bewailing its loss.

— The people of Vienna have been greatly alarmed by the outbreak of a new epidemic, which is believed by some to be connected with the influenza. It affects the intestines, its symptoms being fever and acute colic, with the ejection of blood. Its appearance seems to indicate the absorption of some poisonous matter. At first it was attributed to the drinking-water, but this view has been generally abandoned. A representative of a Vienna newspaper has taken the opinion of some of the Vienna physicians on the subject. Professor Nothnagel hesitated to pronounce any judgment on the illness, the facts not having been sufficiently studied. Professor Drasche thought it might be "nothing else than a distinct form of influenza," and was confident that it was not due to the drinking-water. Professor Oser was also sure that the drinking-water had nothing to do with the disease, and "did not consider that there was any indisputable evidence of its connection with influenza." Dr. Bettelheim seemed to think that there was something in common between influenza and the new malady called "catarrh of the intestines." He based his opinion on the fact that from the day when the latter made its appearance in an epidemic form cases of ordinary influenza had begun to decrease. He looked upon them both as being of an infectious nature. A chemical analyst, Dr. Jolles, said it would require three weeks to make a bacteriological inquiry into the character of the illness. A chemical analysis of the drinking-water, says *Nature*, showed it to be of normal purity.

— *Nature* prints some notes by Mr. J. J. Walker, R N., on ants' nest beetles at Gibraltar and Tangier, with especial reference to the Hisperidæ. The search for ants' nest Hister is a somewhat troublesome employment, as only about two or three per cent of the ants' nests contain the beetle. Mr Walker, however, thinks "it is a pretty sight, and one which compensates for a great deal of strain to the eyes, as well as to the back, to see a *Sternocœlis* or *Eretmotus* lying motionless among the hurrying crowd of ants and then, suddenly developing an amount of leg quite surprising in so small a creature, marching off daintily on the tips of its toes (or rather tarsi) with a ludicrous resemblance, in gait and appearance, to a tiny crab." The comparatively weak mandibles of the ants are ineffective against the hard armor and tightly-packed limbs of the beetles, which devour the helpless brood with impunity. Mr. Walker has more than once taken *S. acutangulus* with a half-eaten larva in his jaws, and they are usually to be found clinging to the masses of larvæ where these lie thickest. On the other hand, he once (but once only) saw an ant take up a *S. arachnoides* in its mandibles and carry it off into a lower gallery of the nest; but this may have been done under the influence of alarm, the frightened ant seizing on the first object that came in its way.

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ESTIMATES OF DISTANCE.

HERBERT NICHOLS, in his experiments on "The Psychology of time" (*American Journal of Psychology*, April, 1891), has shown that estimates of time intervals are influenced by immediately preceding estimates, so that, in general, intervals are judged to be longer after practice on estimating an actually longer interval than when no such practice precedes, and shorter after practice on a shorter interval. The experiments about to be described were undertaken to see whether the same rule applies to estimates of distance. They show no such effect, perhaps because the intervening practice was not sufficiently sustained to affect the judgment. But the results are interesting for several reasons, and they are therefore given below.

The mode of experimenting was as follows: On each of three sheets of unruled paper (about six by nine inches) was placed a pair of pencil dots; on the first these were 4.02 inches apart; on the second .92 of an inch; on the third exactly the same distance as on the first. Without being told the object of the experiments, the person to be experimented on was shown the first pair of dots, allowed to look at them as long as he pleased, and then, the paper being taken away, told to make from memory, on a slip $9 \times \frac{1}{2}$ inches, two dots at the same distance apart, as nearly as he could. This was repeated on a fresh sheet, without his looking at the model again, and so on till he had made ten trials. The same thing was then repeated with the second and third sheets.

The following table shows the results, the first column giving the difference between the actual distance of the dots and the average of the ten estimates in each series; the second column the percentage of this difference to the actual distance; the third the mean deviation of the estimates from the average (taken always as positive); and the fourth the percentage of this mean to the actual distance. All distances are in decimals of an inch.

Persons.	Error of Average.			Per Cent.			Mean Deviation from Average.			Per Cent.		
	I.	II.	III.	I.	II.	III.	I.	II.	III.	I.	II.	III.
S. S....	+.65	−.17	+.92	16	16	23	.13	.04	.12	3	4.5	3
J. S....	−.10	+.21	+.70	2 5	23	17	.14	.13	.14	3	14	3
A. L. B.	−1.35	−.30	−1.31	33 5	33	32.5	.14	.07	.25	4	5	6
E. S....	+.26	+.31	−.19	6	33	5	.31	.09	.23	8	10	6
L. B...	+ 75	+.18	+.68	19	19.5	17	.24	.04	.26	6	5	6
M. S.. .	−.31	+.20	+.45	8	21	11	.17	.09	.28	4	9	7
L. F....	+.05	+.07	−.01	1	7.5	0.2	.09	.04	.06	2	4	1.5

The degree to which the absolute value of the errors depends on previous training is plainly shown; for instance, L. F., in whose case they are remarkably small, is the daughter of a well-known artist and herself accomplished in the use of the pencil, while A. L. B. is a boy five years of age. The consistency of the estimates seems, however, to depend much less on training, as shown in the third column, the ratio of A. L. B's. mean deviations to those of L. F. being about 1.5, 1.7, and 6.8 for the three series respectively, while the ratios of their errors (from the first column) are 27, 4, and 131. In the cases of S. S., A. L. B., and L. B. the errors are nearly proportional to the actual length of the intervals, which would seem the natural rule; but in the other cases there seems a tendency toward making errors of the same absolute value in estimating both short and long intervals. A. L. B., whose absolute errors are far the largest, keeps them most nearly proportional. The mean deviations are much more generally proportional to the intervals, the most noticeable exception being that of J. S.—also the chief exception to proportionality in the former case.

ARTHUR E. BOSTWICK.

THE LATEST ADVANCES IN SPECTRUM PHOTOGRAPHY.

A LETTER just received by the present writer from Mr. Victor Schumann of Leipzig, whose work in the domain of spectrography is less widely known and appreciated than it deserves to be, reveals such surprising advances within the past year in photographing radiations in the ultra-violet spectrum, that I am impelled to present the following summary of Mr. Schumann's results.

More than two years ago he demonstrated the remarkable absorptive effect of air upon very short vibrations, so great, indeed, that even the air within the tubes of the spectrograph was a serious obstacle to the investigation. However, he was able, with the apparatus then at hand, to demonstrate the existence of lines up to and beyond wave-length 1,852 by photography, using the light of the aluminum spark.

With the fine skill and ingenuity which has ever characterized his work, Mr. Schumann has since constructed a spectrograph exhausted of air, with lenses and prism of white fluor-spar. The source of light for these researches was the hydrogen Geissler tube. With the "exhausted spectroscope," as it is termed, and plates of proper sensitiveness, Mr. Schumann finds the photographic action of the spectrum beyond wave-length 1,852 very strong indeed. It is composed of fourteen groups of lines, including altogether about six hundred lines. The boundary of this hitherto entirely unknown portion of the spectrum extends about four times as far from the most refrangible line hitherto photographed (the aluminum line 1,852), as that line is beyond the blue hydrogen line of wave-length 4,861. The interest in these researches is, therefore, very great; and it seems as though the limit of the radiations might only be reached when we can detect them in the universal ether itself, unaffected by a trace of an absorptive medium, and with photographic plates of special character.

The ordinary plates do not serve for work of this kind. The plates used by Mr. Schumann are specially made by himself, and are peculiar in possessing great sensitiveness to the ultra-violet rays, but relatively very little to the light of the visible spectrum. Because of this insensitiveness to the visible spectrum, the plate acts toward the ultra-violet precisely like one exposed to filtered light, from which all the rays have been absorbed, which, as diffused light in the spectrograph, would tend to cause fogginess of the picture. Such is the effect when an attempt is made to photograph the ultra-violet spectrum with an ordinary plate; for, before the ultra-violet rays have affected the plate, or produced a distinct image, the plate is fogged all over by the diffused light. The method of making the new plates is not yet published, because the investigations are not yet completed nor ready for publication.

Photography in a vacuum presents some difficulties and requires far greater care than under ordinary conditions, even under the most favorable conditions the photographic effect of these extremely refrangible radiations is relatively so very weak that on many plates prepared according to the new method it was difficult to establish even the existence of the vibrations of the shortest wave-lengths.

We may look forward with the greatest interest to the early publication of full details and results of this most skilfully conducted investigation, which has so greatly extended the known limits of the invisible spectrum.

ROMYN HITCHCOCK.

1455 Mass. Ave., Washington, D.C., Feb. 20.

METALS AT HIGH TEMPERATURES.

ON Feb. 5, Professor Roberts-Austen, C.B., gave a very interesting lecture on metals at high temperatures at the Royal Institution. As was to be expected, nothing very novel was brought forward, but the lecturer certainly succeeded in demonstrating to a large audience results which have hitherto been only obtained in the laboratory. Every one who has ever heard Professor Roberts-Austen lecture, knows his fondness for experimenting with gold, which no doubt is mainly due to his position at the mint, though, apart from this, many would find a certain fascination in handling and experimenting with such a metal. Moreover, gold is a metal remarkable for other properties besides its monetary value. On previous occasions Professor Roberts-Austen has drawn attention to the fact that its properties are changed in a most remarkable manner by alloying it with small percentages of other metals, and on the present occasion he exhibited a new series of alloys of this metal with aluminium which are of equal interest to those previously known. One of these alloys in particular, containing 20 per cent of aluminium, is noteworthy, as it forms an exception to the usual rule that the melting point of an alloy is lower than that of either of its constituents. This alloy, on the other hand, has a fusing point above that of gold, the most infusible of its constituents. Curiously enough, the alloy with 10 per cent of aluminium follows the ordinary rule. These alloys, it should be added, have the most brilliant colors. The 20 per cent alloy is a brilliant ruby in tint, whilst those containing greater percentages of aluminium are purple in hue.

With the aid of the oxy-hydrogen blowpipe and M. Le Chatalier's pyrometer, the lecturer was able to show a large audience the peculiarities of the cooling curves of several metals, and also to measure the fusing points of some of the most refractory of them. Indeed, he succeeded in fusing iridium, using for the purpose the electric arc, the thermocouple employed as pyrometer consisting of a rod of iridium, and a rod of an alloy of the same metal with 10 per cent of platinum. The temperature thus reached is stated to be the highest yet measured, viz., 2,000° C., and thus it is now possible to measure temperatures ranging from $-200°$ C. to $+2,000°$ C., the former temperature having been attained by Professor Dewar in his lecture to the Royal Institution some short time back.

Even before the invention of this instrument, Professor Roberts-Austen stated that very considerable progress had been made in pyrometry, so that Mr. Callender, with his improved Siemens apparatus, in which the change in the resistance of a platinum coil, as it grows hotter, is used as a measure of the temperature to which it is exposed, has succeeded in measuring temperatures of 1,500° C., with an error of not more than one-tenth of a degree.

In measuring lower temperatures than the fusing point of iridium, the thermo-couple used consisted of a couple of wires, one of platinum and the other of an alloy of this metal with 10 per cent of rhodium, simply twisted together. This couple was inserted in the mass of a clay dish, on which gold and palladium, etc., were melted by the aid of an oxy-hydrogen flame. The ends of the wires were coupled with a suitable reflecting galvanometer, which by means of a powerful lantern threw a bright spot of light on a long scale fixed to the wall of the lecture-room. By means of this apparatus Professor Roberts-Austen was able to exhibit the recalescence of iron and show that at this point the metal suddenly becomes magnetic. For this purpose a block of iron heated to redness was placed on a stand fitted with a thermo-couple and an ordinary magnetic needle, which carried a mirror reflecting a second spot of light on the screen. At a high temperature iron is non-magnetic, but as it cooled down the spot of light from the pyrometer travelled down its scale, till at the point of recalescence it became stationary, and at the same moment the second spot of light connected with the magnetic needle suddenly swung over, showing that the metal had then become magnetic. Of more immediate interest, from a practical point of view, was a second experiment exhibited. In this a bar of iron, heated to bright redness, was fixed at one end and loaded at the other. Instead of bending over under the influence of the weight, which of course was not large, it remained rigid until it had cooled down to its point of recalescence, when it suddenly began to deflect.

Professor Roberts-Austen maintains that these peculiarities point to a re-arrangement of the molecules of the metal, and that they occur even with chemically pure iron, being intrinsic in the metal and not merely the effect of foreign constituents, though of course these are of considerable importance in modifying the results observed. That such changes occur in practice there can be little doubt, though the effects seem often to be peculiarly local. Steel plates showing very considerable ductility on test have snapped simply from internal stresses without showing the slightest signs of elongation or contraction of area at the point of fracture, making it difficult to believe that during fracture the molecular arrangement of the particles affected by the fracture has been the same as when specimens of the same plate have shown perhaps 18 per cent elongation and 30 per cent contraction of area in the testing machine. These facts would almost lead to the conclusion that a sort of wave of molecular change may arise in a steel plate, during which abnormal fracture may occur, and after which the material of the plate may be found in its ordinary condition. By working at a blue heat, it is known that such a molecular change is produced, and the fracture of a mild steel bar thus treated shows that the metal has become brittle, but such a change is permanent. It is, moreover, certain that liability to this class of fracture is increased by the presence of certain impurities in the metal, the amount of which is often astonishingly small, and much light will probably be thrown on these points, says *Engineering*, by investigations now in progress.

It is not necessary that these investigations should, in the first place, be conducted on steel itself, as it frequently happens in scientific work that a problem is more easily solved by first dealing with simpler analogous cases than by a direct attack on it in all its complexity. For a flank attack of this character, gold, apart from its value, offers many advantages, as it is easily obtained in the pure state, and is at the same time profoundly affected by alloying it with very small quantities of other metals, which changes it is difficult to explain on any other hypothesis than that of an altered molecular grouping.

JOURNEYS IN THE PAMIRS AND ADJACENT COUNTRIES.[1]

THIS was the subject of the paper read at the meeting of the Royal Geographical Society, on Feb. 8, by Capt. F. E. Younghusband. The author described two journeys, one in 1889 across the Kárákorum and into the Pamir, the other in 1890 to Yarkand and Kashgar, and south to the Pamirs again.

"The country," he said, "which I now wish to describe to you is that mountainous region lying to the north of Kashmir, which, from the height, the vastness, and the grandeur of the mountains, seems to form the culminating point of western Asia. When that great compression in nature took place this seems to have been the point at which the great solid crust of the earth was crunched and crushed together to the greatest extent, and what must have formerly been level peaceful plains such as we see to the present day on either hand, in India and in Turkistan, were pressed and upheaved into these mighty mountains, the highest peaks of which are only a few hundred feet lower than Mount Everest, the loftiest point on this earth. It was amongst the peaks and passes, the glaciers and torrents of this awe-inspiring region, and anon over the plain-like valleys and by the still, quiet lakes of the Pamirs that my fate led me in the journeys which I have now come before you to describe."

Starting from Leh, in Ladak, Captain Younghusband's first objective point was Shahidula. This place is situated on the trade route to Yarkand, and is 240 miles distant from Leh. This he left on Sept. 3, to explore the country up to the Tagh dum-bash Pamir.

The route now led up the valley of a river, on which were several patches of fine grazing, and till last year this had been well inhabited, but was now deserted on account of Kanjuti raids. The valley is known by the name of Khál Chuskún. Chuskún in Turki means resting-place, and Khál is the name of a holy man from Bokhara, who is said to have rested here many years ago. The mountains bounding the north of this valley are very bold and rugged, with fine upstanding peaks and glaciers; but the range to the south, which Hayward calls the Aktágh Range, was somewhat tame in character, with round mild summits and no glaciers. The Sokhbulák is an easy pass, and from its summit to the east could be seen the snowy range of the western Kuenlun Mountains, while to the west appeared a rocky mass of mountains culminating in three fine snowy peaks, which Hayward mistook as belonging to the main Mustagh Range, but which in fact in no way approach to the height and magnificence of those mountains, and really belong to the Aghil Range, which is separated from the Mustagh Mountains by the valley of the Oprang River.

On Sept. 11, the party crossed the remarkable depression in the range which is known as the Aghil Pass.

"From here is obtained one of the grandest views it is possible to conceive; to the south-west you look up the valley of the Oprang River, which is bounded on either side by ranges of magnificent snowy mountains, rising abruptly from either bank, and far away in the distance could be seen the end of an immense glacier flowing down from the main range of the Mustagh Mountains This scene was even more wild and bold than I had remembered it on my former journey, the mountains rising up tier upon tier in a succession of sharp needle like peaks, bewildering the eye by their number, and then in the background lie the great ice mountains — white, cold, and relentless, defying the hardiest traveller to enter their frozen clutches. I determined, however, to venture amongst them to examine the glaciers from which the Oprang River took its rise, and leaving my escort at the foot of the Aghil Pass, set out on an exploration in that direction. The first march was easy enough, leading over the broad pebbly bed of the Oprang River. Up one of the gorges to the south we caught a magnificent view of the great peak K 2, 28,278 feet high, and we halted for the night at a spot from which a view of both K 2 and of the Gushirbrum peaks, four of which are over 26,000 feet, was visible. On the following day our difficulties really began. The first was the great glacier which we had seen from the Aghil Pass; it protruded right across the valley of the Oprang River, nearly touching the cliffs on the right bank; but fortunately the river had kept a way for itself by continually washing away the end of the glacier, which terminated in a great wall of ice 150 to 200 feet high. This glacier runs down from the Gushirbrum in the distance towering up to a height of over 26,000 feet. The passage round the end of the glacier was not unattended with danger, for the stream was swift and strong, and on my own pony I had to reconnoitre very carefully for points where it was shallow enough to cross, while there was also some fear of fragments from the great ice-wall falling down on the top of us when we were passing along close under it. After getting round this obstacle we entered a gravel plain, some three quarters of a mile broad, and were then encountered by another glacier running across the valley of the Oprang River. This appeared to me to be one of the principal sources of the river, and I determined to ascend it. Another glacier could be seen to the south, and yet a third coming in a south-east direction, and rising apparently not very far from the Kárákorum Pass. We were, therefore, now in an ice-bound region, with glaciers in front of us, glaciers behind us, and

[1] Nature, Feb. 11.

glaciers all around us. Heavy snow-clouds too were unfortunately collecting to increase our difficulties, and I felt that we should have a hard task before us. On first looking at one of these glaciers it would appear impossible to take ponies up them, but the sides are always covered with moraine, and my experience in the exploration of the Mustagh Pass in 1887 showed that, by carefully reconnoitring ahead, it was generally possible to take the ponies for a considerable distance at least up such glaciers; and as the one we had now reached seemed no worse than others, and there appeared a gap in the range which looked as if it might be a pass, I took my ponies on, and after three days' scrambling on the ice, reached the foot of the supposed pass, and started at 3.30 on the following morning to find if it was at all practicable."

Captain Younghusband was, however, obliged to return after reaching a height of 17,000 feet, and he decided to return to his camp on the Oprang River. He thus describes the glaciers from which this river takes its rise: —

"The length of this glacier is 18 miles, and its average breadth half a mile; it is fed by three smaller glaciers on the west and one on the east. At its upper part, immediately under the pass, it is a smooth undulating snow-field about a mile and a half in width. Lower down this *névé* is split up into crevasses, which increase in size the further down we get. Then the surface gradually breaks up into a mass of ice-domes, which lower down become sharp needle-like pinnacles of pure white ice. On each side lateral gravel moraines appear, and other glaciers join, each with its centre of white ice-peaks and its lateral moraines, and preserving each its own distinct course down the valley, until some three miles from its termination in the Oprang River, when the ice-peaks are all melted down and the glacier presents the appearance of a billowy mass of moraine, and would look like a vast collection of gravel heaps, were it not that you see, here and there, a cave or a cliff of ice, showing that the gravel forms really only a very thin coating on the surface, and that beneath is all pure solid ice. This ice is of opaque white, and not so green and transparent as other glaciers I have seen, and the snow at the head of the glacier was different from any I have seen before; for beneath the surface, or when it was formed into lumps, it was of the most lovely pale transparent blue. I must mention, too, that every flake of snow that fell in the storm was a perfect hexagonal star, most beautiful and delicate in form. The mountains on either side of the valley, especially on the eastern side, are extremely rugged and precipitous, forming little or no resting-place for the snow, which drains off immediately into the glacier below. The western range, the main Mustagh Range, was enveloped in clouds nearly the whole time, and I only occasionally caught a glimpse of some peak of stupendous height, one of them, the Gushirbrum, over 26,000 feet, and others 24,000 feet. The snowfall on these mountains must be very considerable, and it seems that this knot of lofty mountains attracts the great mass of the snow-clouds, and gets the share which ought to fall on the Kárákorum, while these latter, being lower, attract the clouds to a less degree, and are in consequence almost bare of snow."

After some further exploration of the glaciers, rivers, and passes in this wild region, Captain Younghusband returned to India by way of Kashmir. In the summer of 1890, he once more made his way northwards through Kashmir, with a companion, Mr. Macartney. They reached Yarkand on Aug. 31.

"After a rest of two or three weeks at Yarkand," Captain Younghusband went on to say, "Macartney and I left our companions and started for a trip round the Pamirs. Approaching this interesting region from the plains of Kashgaria, one sees clearly how it has acquired the name of Bam i-dunya, or Roof of the World. The Pamir Mountains rise apparently quite suddenly out of the plain from a height of 4,000 feet above sea-level at their base to over 25,000 feet at their loftiest summits — a massive wall of rocks, snow, and ice. Mounting this wall the traveller comes on to the Bam-i-dunya, which would perhaps be better translated as the 'upper story' of the world. Houses in Turkistan are flat-roofed, and you ascend the outer wall and sit out on the roof, which thus makes an upper story, and it appears to me that it was in this sense that the Pamir region was called the Roof of the World. The name, indeed, seems singularly appropriate, for once through the gorges which lead up from the plains, one enters a region of broad open valleys separated by comparatively low ranges of mountains. These valleys are known as Pamirs — Pamir being the term applied by the natives of those parts to a particular kind of valley. In the Hindu Kush and Himalayan region the valleys, as a rule, are deep, narrow, and shut in. But on the Roof of the World they seem to have been choked up with the *débris* falling from the mountains on either side, which appeared to me to be older than those further south, to have been longer exposed to the wearing process, and to be more worn down — in many parts, indeed, being rounded off into mere mounds, reminding one very much of Tennyson's lines: —

> 'The hills are shadows, and they flow
> From form to form, and nothing stands;
> They melt like mist; the solid lands,
> Like clouds they shape themselves and go.'

The valleys have thus been filled up faster than the rainfall has been able to wash them out, and so their bottoms are sometimes as much as four or five miles broad, almost level, and of considerable height above the sea. The Tagh-dumbash Pamir runs as low as 10,300 feet, but, on the other hand, at its upper extremity the height is over 15,000 feet; and the other Pamirs vary from twelve or thirteen to fourteen thousand feet above sea-level. That is, the bottoms of these Pamir valleys are level with the higher summits of the Alps.

"As might be expected, the climate is very severe. I have only been there in the autumn, and can therefore speak from personal experience of that season only; but I visited them in three successive years, and have seen ice in the basin of my tent in August. I have seen the thermometer at zero (Fahrenheit) at the end of September, and 18° below (that is, 50° of frost) at the end of October. The snow on the valley bottoms does not clear away before May is well advanced. June and July and the beginning of August are said to be pleasant, though with chilly nights; and then, what we in England might very justly call winter, but which, not to hurt the feelings of the hardy Kirghiz who inhabit these inhospitable regions all the year round, we will, for courtesy's sake, call autumn, commences."

Captain Younghusband and Mr. Macartney advanced up those long gravel desert slopes which lead out of the plains of Turkistan, and then through the lower outer ranges of hills covered with a thick deposit of mud and clay, which Captain Younghusband believes to be nothing else than the dust of the desert, which is ever present in the well known haze of Turkistan, deposited on the mountain-sides; then over the Kara-dawan, Kizil-dawan, and Torat Passes; through the narrow defile known as the Tangitar, where one has to force the ponies up a deep, violent stream rushing over huge bowlders between precipitous, rocky cliffs, in which they noticed large, square holes pierced, suggesting to them that in former days this, the high road between Eastern and Western Asia, was probably improved by having a bridge over this difficult and dangerous part; then over the Chichiklik and Koh-mamak Passes and the Tagarma Plain, till they reached the neighborhood of Tash-kurgan, the northernmost point of Captain Younghusband's explorations in the previous year. Passing through the Little Pamir, they struck the Alichur Pamir near Chadir-tash at its eastern extremity, and from there they looked down a broad level valley, averaging four or five miles in width, to some high, snowy peaks overhanging Lake Yeshil-kul at its western extremity. The range bounding this Pamir on the north is free of snow in summer, but that separating it from the Great Pamir is of considerable height, the summits are always covered with snow, and the passes across it difficult. Traces of ancient glaciers are very frequent, and the western end near Lake Yeshil-kul is choked up with their moraines, forming a sea of gravel mounds, in the hollows of which numerous lesser lakes may be seen. On the borders of Yeshil-kul, at a place called Somatash, Captain Younghusband found the fragments of a stone bearing an ancient inscription in Turki, Chinese, and Manchu. This interesting relic, as far as Captain Younghusband has been able to get the rubbings he took of it translated, refers to the expulsion of the two Khojas from Kashgar by the Chinese in 1759, and relates how they were pursued to the Badakhshan frontier.

From the Ak-su Valley the two travellers ascended the sterile valley of the Ak-baital, which at this season of the year (October) has no water in it, and visited Lake Rang-kul. "On the edge of this lake is a prominent outstanding rock, in which there is a cave with what appears to be a perpetual light burning in it. This rock is called by the natives Chiragh-tash, i.e., the Lamp Rock, and they account for the light by saying that it comes from the eye of a dragon which lives in the cave. This interesting rock naturally excited my curiosity. From below I could see the light quite distinctly, and it seemed to come from some phosphorescent substance. I asked the Kirghiz if any one had ever entered the cave, and they replied that no one would dare to risk the anger of the dragon. My Afghan orderly, however, had as little belief in dragons as I had, and we set off to scale the cliff together, and by dint of taking off our boots and scrambling up the rocks, very much like cats, we managed to reach the mouth of the cave, and on gaining an entrance found that the light came neither from the eye of a dragon nor from any phosphorescent substance, but from the usual source of light — the sun. The cave, in fact, extended to the other side of the rock, thus forming a hole right through it. From below, however, you cannot see this, but only the roof of the cavern, which, being covered with a lime deposit, reflects a peculiar description of light. Whether the superstitious Kirghiz will believe this or not I cannot say, but I think the probability is that they will prefer to trust to the old traditions of their forefathers rather than the wild story of a hare-brained stranger. The water of the Rang-kul is salt, and the color is a beautiful clear blue. The mountains in the vicinity are low, rounded, and uninteresting, though from eastern end a fine view of the great snowy Tagarma Peak may be obtained."

The winter was spent in Kashgar. On July 22, 1891, Captain Younghusband left to return to India by way of the Pamirs and Gilgit.

"On reaching the Little Kara-kul Lake, a piece of interesting geography, which I believe had been first noticed by Mr. Ney Elias, on his journey through these parts some years ago, presented itself. Captain Trotter of the Forsyth mission saw from the plains of Kashgar a stupendous peak, the height of which he found to be 25,300 feet, and the position of which he determined accurately. From Tash-kurgan or its neighborhood he also saw a high mountain mass in the direction of the peak he had fixed from near Kashgar; bad weather prevented his determining the position of this second peak, but he thought there was no doubt that the two were identical. Such, however, is not the case. There are two peaks, about twenty miles apart, one on either side of the Little Kara-kul Lake. That seen from Tash-kurgan is the true Tagarma Peak, and cannot be seen from Kashgar; while that seen from Kashgar cannot be seen from Tash-kurgan. There appeared to me to be very little difference in height between the two. Both are remarkable not only for their extraordinary height, but also for their great massiveness. They are not mere peaks, but great masses of mountain, looking from the lake as if they bulged out from the neighboring plain; and one sees far more distinctly than is usually the case, the layers upon layers of rock which have been upturned like the leaves of a book forced upwards. It struck me, too, especially from the appearance of the rocks in the neighborhood of the northernmost peak, that these must have been upheaved far more recently than the worn-out-looking mountains in the centre of the region of the Pamirs. The appearance of these two great mountain masses rising in stately grandeur on either side of a beautiful lake of clear blue water is, as may be well imagined, a truly magnificent spectacle, and, high as they are, their rise is so gradual and even that one feels sorely tempted to ascend their maiden summits and view the scene from the loftiest parapets of the 'Roof of the World.'"

On Oct. 4 Captain Younghusband and a companion left the Tagh-dum-bash Pamir to explore "an interesting little corner of Central Asia, the point where the two watersheds — the one between the Indus on the south and the Oxus and Eastern Turkistan Rivers on the north, and the other between the Oxus on the west and the Eastern Turkistan Rivers on the east — join. If any point can be called the Heart of Central Asia I should think this must be it. Here on the Oxus side of the watershed are vast snow-fields and glaciers, and among these, with three of its sides formed of cliffs of ice — the terminal walls of glaciers — we found a small lake, about three-quarters of a mile in width, out of which flowed the stream which joins the Panja branch of the Oxus at Bozai-Gumbaz."

After this Captain Younghusband made his way down to Kashmir.

FURTHER CONFIRMATION OF THE DISCOVERY OF THE INFLUENZA BACILLUS.

IN January, 1890, Professor Babes of Bucharest investigated nine cases of influenza. The difficulty of studying them was increased from the fact that complications with other diseases were involved. Unfortunately, also, no experiments were made upon animals. Yet, from the results then found,[1] it will be seen that the bacteria are the same as those discovered by Pfeiffer, which Babes himself acknowledges.[2]

[1] Centralblatt für Bacteriologie, Bd. VII., No. 8, 15, 17–19.

[2] Deutsche Med. Wochenschrift, Feb. 11, 1892.

The bacteria showed the following peculiarities: —

1. In fresh cases the bacteria are found in large masses in the mucus, that is, in the inner of the leucocytes; they form a thick layer on the surface of the inflamed mucous membrane, and press into the superficial lymph-spaces and often also into the inner organs.

2. They form very fine, generally pointed, diplobacteria, or short rods, with a diameter of 0.2μ, often making chains. One recognizes in the inner of the same chromatic granules; these appear to be surrounded by a light zone, and they are without motion. With aniline colors they stain feebly, in single cases better, and are faint, or do not stain at all (except the chromatic granules), with Gram's method. In older cases and cultures, as in the inner of the leucocytes, the bacterium is found in a state of granular disintegration, frequently lessened in size or swollen so that the thickness of the individual bacteria can vary between 0.1 and 0.3 μ. The thickness also varies according to the coloring matter employed.

3. The bacteria can be cultivated in many cases, especially in glycerine. There are formed here, especially deep in the nutrient medium, very small rod-like colonies.

4. The bacterium is pathological for rabbits, since in some cases its introduction into healthy nasal cavities causes a sort of sepsis, pneumonia, and death of the animal.

From Babes's investigations it appears that white mice are not always immune against greater quantities of the culture or the products of the disease, and that they can die.

As there is now no special difficulty in recognizing and cultivating the very small bacteria in cover-glass preparations, it is to be hoped that they may be made valuable in diagnosis, and that a way for preventing and subduing the disease may be experimentally investigated.

Georgetown Medical School. A. MACDONALD.

LETTERS TO THE EDITOR.

Making an Herbarium or Preserving Plants.

THIS is the time of year when botanists are making plans for the summer campaign. I am not going through the subject by going into details, as *Science* has recently noticed several small manuals which treat fully of the subject. I wish to emphasize a few points which have received too little attention. I am somewhat familiar with the collecting done by the older botanists of this country, and with some in other countries.

We have a great advantage in many ways over the older collectors. We are learning all the time from each other. We are going deeper and deeper into the study of plants.

Almost everyone who preserves specimens, on the start hoards up a lot of worthless trash — of snips, tops, and mere fragments. Don't do it, but study the subject well from every side. I speak now more particularly with reference to grasses; but the following statement, I feel sure, will apply with almost equal force to most families of plants. This is the statement which I believe to be true, with very few exceptions: —

All truly good herbarium specimens have been made within the past twenty years, and a very large proportion of those prepared during the last twenty years are far from good. It is no injustice to others to say that, so far as I know, C. G. Pringle of Vermont, by his fastidiousness in this matter, started a reform which seems to be rapidly spreading. We should have an abundance of material, lower leaves, flowers, fruit, and root-stalks, if there are any, and little packages of nuts, flowers, and seeds on the sheet for study. Some years ago I spoke of the importance of preserving seedlings of many of our plants. This is a good time to refer to this part of the subject, since Mrs. Kellerman has illustrated the seedling blackberry. Turn to page ninety-four and study it. Go to raising seedlings, or pick them up wherever they can be found. Look out, too, for buds of trees and shrubs, and collect them before the inner scales have fallen — as they are opening. Do not be satisfied with mediocrity, but strive to have everything neat and complete. W. J. BEAL.

Agricultural College, Ingham Co., Mich., Feb. 22.

The Barn Owl a Winter Resident in Ohio.

THAT the barn owl, *Strix pratincola*, is, at least, a rare winter resident of central Ohio can no longer be questioned. A few days since two individuals were found in the hollow trunk of a sycamore tree at Utica, Licking County. One of them was killed by the fall of the tree; this I have not seen. The other was taken alive, and I had the satisfaction of seeing it last week in the possession of Mr. Newkirk of Newark, O. There is no doubt as to its identity, nor can I think there is any regarding the stated time and place of capture.

There are but few recorded instances of its occurrence in the State, and none of the dates at hand are in winter. Dr. J. M. Wheaton, in "Reports on the Birds of Ohio," says, "Rare visitor. Mr. Oliver Davie of this city [Columbus] has a specimen . . . killed in this vicinity Nov. 2, 1878. The dates of captures [Circleville, summer, 1873; Columbus, November, 1878; near Cincinnati, April, 1880] indicate that it is, at least, a summer resident of the State." It would seem that it is a permanent resident; in all probability rearing its young in central Ohio.

D. S. KELLICOTT.

Ohio State University, Columbus, Feb. 17.

A Magnetic Cane.

CAPT. D. P. SANFORD of this city owns a walking-stick that possesses magnetic properties, but how it came by them he is unable to explain. Several years ago he purchased a strong, heavy cane, having for its central portion a rod of excellent quality of steel, extending throughout its entire length. At the lower end it is about the thickness of the ordinary lead pencil; at the top nearly three-quarters of an inch in diameter. Its outer part is composed of leather, which, having been cut into rings, was forced, one ring upon another, till solid from end to end. This was rounded, smoothed and polished, and varnished. The cane was finished, first, by enclosing the lower end with a steel ferrule through which the central steel rod projected half an inch; second, by covering the upper end of the cane with a circular copper plate over an inch in diameter, and about one-sixteenth of an inch in thickness.

The cane was never near a magnet to its owner's knowledge; but recently he has noticed its magnetic property, which, in his belief, is growing stronger. Now, what causes this?

The water-tight non-conducting covering insulates the rod perfectly, except at the lower end, where, as a matter of course, it constantly comes in contact with the earth. The upper part, covered with the copper plate, is held in the warm and moist hand for hours at a time. Now, will the conditions of insulation, two metals, moisture of earth and hand, and difference in temperature between the two ends, account for the exhibition of magnetic properties? Will some one offer an explanation?

A. H. BEALS.

Milledgeville, Ga., Feb. 20.

[If the writer of the above will take any steel rod and give it a number of raps while held in a more or less vertical position he will find that it will become magnetic.—ED.]

AMONG THE PUBLISHERS.

THE question of "Speed in Locomotives," which for a time has superseded in popular interest the luxuries of railroad travel, will be discussed in the March *Scribner* by a notable group of railway authorities. M. N. Forney, editor of *The Railroad and Engineering Journal*, will consider the question of "The Limitations of Fast Running;" Theodore N. Ely, General Superintendent Motive Power, Pennsylvania Railroad, will treat of "Train Speed as a Question of Transportation;" H. Walter Webb, Third Vice-President of the New York Central, will describe "A Practical Experiment" — the running of the Empire State express. The views of three such authorities, presented in a popular way in one number, give for the first time an adequate knowledge to the public of the difficulties and risks involved in running through trains at a high rate of speed.

— P. Blakiston, Son, & Co., Philadelphia, have nearly ready a "Monograph on Physical Education," by Frederick Treves, F.R.C.S., printed from the advance sheets of "A Treatise on Hygiene," by various authors. It is a systematic exposition of a very important subject that is at present attracting the attention of school boards, college trustees, physicians, and sanitarians generally.

— To Skakespeare students the plan and scope of Dr. Furness's variorum edition is universally known, as are the infinite pains, judgment, and critical faculty expended in the exposition of each play. Every volume as it appears brings into one focus all the wealth of a great Shakespeare library, so arranged as to be immediately accessible. "The Tempest" is the ninth volume of this incomparable edition, and will soon be published by J. B. Lippincott Company. The plays previously issued are "As You Like It," "Romeo and Juliet," "Hamlet" (2 vols.), "Macbeth," "King Lear," "Othello," and "Merchant of Venice."

— Under the heading "One Hundred Miles an Hour," Mr. Charles N. Deacon of the Reading Railroad discusses, in the March *Lippincott*, the facts and possibilities of railway speed, and rejects the popular notion that a faster rate necessarily means increased danger.

— J. B. Lippincott Company have just published a new edition of "Soule's Synonymes," revised and enlarged by George S. Howison, Mills professor of philosophy in the University of California.

— Houghton, Mifflin, & Co. will publish immediately the lectures in "The Evolution of Christianity," recently delivered at the Lowell Institute, in Boston, by Rev. Dr. Lyman Abbott, which have been carefully revised by Dr. Abbott for this publication in book form; "Equatorial America," in which M. M. Ballou describes his travels to St. Thomas, Martinique, Barbadoes, and the principal capitals of South America. This house will also shortly issue a new work by A. P. Sinnett, whose "Occult World" and "Esoteric Buddhism" secured so wide a reading. The new book will be named "The Rationale of Mesmerism."

— M. L. Holbrook Company, 23 Clinton Place, New York City, announce for immediate publication a work on the hygienic treatment of consumption, which has been in preparation many years, and which would have been published earlier if it had not been detained to await the verdict on Professor Koch's merits. The book is written mainly for the patient.

— In a volume of more than two hundred pages J. B. Lippincott Company will soon publish "Type-Writing and Business Correspondence," by O. R. Palmer. It is a compendium of the entire subject, and places in the hands of the novice just such information as is most needed. To insure its practical efficiency

CALENDAR OF SOCIETIES.

Women's Anthropological Society of America, Washington.

Feb. 20.—Folk-Lork.

Biological Society, Washington.

Feb. 20.—W. H. Dall, Factors in the Distribution of Animal Life as Illustrated by Marine Forms. It is expected that at each meeting a paper of general biological interest will be introduced for discussion, the above being the first of the series. F. A. Lucas, On Charcharodon mortoni; J. N. Rose, The Flora of the Galapagos Islands; John M. Holzinger, On the Identity of Asclepias stenophylla, Gray, and Acerates auriculata, Engelm.

Appalachian Mountain Club, Boston.

Fed. 25.—Frederick H. Chapin, Ascent of Uncompahgre Peak, Cliff-Dwellings of Navajo Cañon, Colorado (illustrated by about one hundred new stereopticon views.)

Wants.

Any person seeking a position for which he is qualified by his scientific attainments, or any person seeking some one to fill a position of this character, be it that of a teacher of science, chemist, draughtsman, or what not, may have the 'Want' inserted under this head FREE OF COST, *if he satisfies the publisher of the suitable character of his application. Any person seeking information on any scientific question, the address of any scientific man, or who can in any way use this column for a purpose consonant with the nature of the paper, is cordially invited to do so.*

A PROFESSORSHIP in Chemistry is wanted by one who has had five years' experience in that capacity. Would prefer to give instruction by lectures and experiments rather than by text-book methods. Would like a position in a college or university where there is a good student's laboratory. Special points of strength claimed are: (1) Thorough control of a class and good order during lectures and recitations. (2) Accuracy in experimenting with chemicals and skill in the manipulation of chemical apparatus. The permission of several distinguished educators has been given to refer to them if required. Would not care to accept a position paying less than $1,500. Address B. E., care of *Science*, 874 Broadway, New York.

ADDRESS WANTED.—Will some one please send the address of the Secretary of the American Philological Society. Also that of Herbert Spencer. "ADDISON," Room 84, 164 Madison St., Chicago, Ill.

ADDRESSES of Old Book Dealers wanted.—Wishing to obtain a number of old books out of print. I very much desire the addresses or catalogues of rare second-hand book dealers. If there is a directory or list of such dealers I should like to obtain possession of one. W. A. BLAKELY, Chicago, Ill.

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WANTED.—(1) A white man versed in wood and iron working, able to work from specifications and plans, suited for an instructor of boys; his business to have charge of shops of school, outline and direct the work for foremen and students; salary to be $1,000 per annum (nine months). (2) A man (black preferred) to teach the colored, iron working and forging, subordinate to the preceding; salary, $720. (3) A man (white) competent to take classes in engineering (assistant's position), but with the ability to perform any of the work required in any of the ordinary engineering courses of our university; salary from $1,000 to $1,500. A. H. BEALS, Milledgeville, Ga.

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For exchange.—Three copies of "American State Papers Bearing on Sunday Legislation," 1891, $2.50, new and unused, for "The Sabbath," by Harmon Kingsbury, 1840; "The Sabbath," by A. A. Phelps, 1842; "History of the Institution of the Sabbath Day, Its Uses and Abuses," by W. L. Fisher, 1859; "Humorous Phases of the Law," by Irving Browne; or other works amounting to value of books exchanged, on the question of governmental legislation in reference to religion, personal liberty, etc. If preferred, I will sell "American State Papers," and buy other books on the subject. WILLIAM ADDISON BLAKELY, Chicago, Ill.

Wanted, in exchange for the following works, any standard works on Surgery and on Diseases of Children: Wilson's "American Ornithology," 3 vols.; Coues' "Birds of the Northwest" and "Birds of the Colorado Valley," 2 vols.; Minot's "Land and Game Birds of New England;" Samuels' "Our Northern and Eastern Birds;" all the Reports on the Birds of the Pacific R. R. Survey, bound in 2 vols., morocco; and a complete set of the Reports of the Arkansas Geological Survey. Please give editions and dates in corresponding. R. ELLSWORTH CALL, High School, Des Moines, Iowa.

Wanted to buy or exchange a copy of Holbrook's North American Herpetology, by John Edwards. 5 vols. Philadelphia, 1842. G. BAUR, Clark University, Worcester, Mass.

For sale or exchange, LeConte, "Geology;" Quain, "Anatomy," 2 vols; Foster, "Physiology," Eng. edition; Shepard, Appleton, Elliott, and Stern, "Chemistry;" Jordan, "Manual of Vertebrates;" "International Scientists' Directory;" Vol. I. *Journal of Morphology;* Balfour, "Embryology," 2 vols.; Leidy, "Rhizopods;" *Science*, 18 vols., unbound. C. T. McCLINTOCK, Lexington, Ky.

To exchange Wright's "Ice Age in North America" and Le Conte's "Elements of Geology" (Copyright 1882) for "Darwinism," by A. R. Wallace, "Origin of Species," by Darwin, "Descent of Man," by Darwin, "Man's Place in Nature," Huxley, "Mental Evolution in Animals," by Romanes, "Pre-Adamites," by Winchell. No books wanted except latest editions, and books in good condition. C. S. Brown, Jr., Vanderbilt University, Nashville, Tenn.

For Sale or Exchange for books a complete private chemical laboratory outfit. Includes large Becker balance (200g. to 1-10mg.), platinum dishes and crucibles, agate motors, glass-blowing apparatus, etc. For sale in part or whole. Also complete file of *Silliman's Journal*, 1862-1885 (62-71 bound); Smithsonian Reports, 1854-1883; U. S. Coast Survey, 1854-1869. Full particulars to enquirers. F. GARDINER, JR., Pomfret, Conn.

the book has been divided into sections giving sample business letters representing widely-different trades, also rules for punctuation and for using the various kinds of type-writing machines.

— Of Dr. Franz Boas's recent publications on the ethnography and linguistics of the American North-west, the following are before us: 1. "Notes on the Chemakum Language," in *American Anthropologist* for January, 1892, pp. 37–44 The people speaking this language were visited by Boas in the summer of 1890 on Puget Sound, and then only three persons were surviving. Before Boas nothing thorough had ever been made public upon this curious and very consonantic language, which forms, together with a dialect on the Pacific Coast, unexplored as yet, a linguistic family by itself. 2. "Third Report on the Indians of British Columbia," contained on pp. 2–43 of Seventh Report on the North-tribes of Canada, Cardiff meeting, 1891, of the British Association for the Advancement of Science; mostly ethnographical and somatological. 3. "Vocabularies of the Tlingit, Haida, and Tshimshian Languages," American Philosophical Society of Philadelphia, Oct. 2. 1891; in its Proceedings, pp. 173–208. These copious word collections are so arranged that the English signification stands first. At the end of the article there are texts and a song in Tshimshian with interlinear translation.

— All teachers and those interested in higher education will be attracted by the paper in the *Atlantic Monthly* for March, by Professor George H. Palmer of Harvard University, entitled "Doubts about University Extension." The writer has given this subject a most careful study, and relates the history of the movement in England and in the United States. He speaks of the difficulties of making it a success here, owing to the different social conditions of the two countries, and suggests plans by means of which the system may be made a possible success in America. The paper will well repay a careful reading.

SCIENCE

A WEEKLY NEWSPAPER OF ALL THE ARTS AND SCIENCES.

PUBLISHED BY N. D. C. HODGES, 874 BROADWAY, NEW YORK.

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Feb. 21.

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SCIENCE

NEW YORK, MARCH 4, 1892.

THE NEED OF PSYCHOLOGICAL TRAINING.

A FEW — only a few — years ago we learned psychology from antiquated text-books that by tales of extraordinary occurrences, quotations of poetry, emphatic assertions, occasional proofs by the phrase "it is evident," and a few improperly observed facts, gave a complete exposition of the human mind in 500 or 600 pages — except in some cases where the author was kind enough to be satisfied with half that amount. To day a psychologist of that kind lectures to bare benches in the universities of Germany, and the new psychology has got such a hold in America that it is rapidly becoming a fashion, if not a fad.

Still, in this very fact there lies a great danger to the proper development of the science. There is a tendency to careless work, to rapid shuffling off of quasi-experimental researches, to a neglect of the drudgery of a scientific investigation of the fundamental problems, and to a pursuit of ghost stories, telepathy, and sensational hypnotic tales. Even where the psychologist is really a scientific man there is a tendency to rest contented with merely qualitative results where quantitative measurements could be made with the exercise of brains and patience.

In regard to the sensationalism and quackery that have assumed the garb of psychology we can do no more than every other science does in that respect, simply put the public on its guard. If, as is usually the case, the public prefers swindle to science; the matter is beyond our control. There is also little to be said against the so-called "theoretical" or "metaphysical" psychology that has blocked scientific development in the past and opposes it in the present. The "metaphysical" psychology is neither metaphysical nor psychological; the term is used merely to cover up the inability or the dislike for careful observation and experiment, it being much easier to sit at home in the study chair and spin out a work on psychology than to put on the apron, clean batteries and smoke chronograph drums in the laboratory.

What is to be called to attention here is the fact that we psychologists are not making the proper efforts toward exactitude in our experiments. In the first place it is becoming too common to consider that going through any careless series of manipulations is making an experiment. An experiment is the systematic variation of the conditions governing a phenomenon in order to observe the results of such a variation. The amount of systematic preparation required and of careful observation to be exercised depends on the stage of development in which the science finds itself. Any lack of preparation that could have been expected, or any deficiency in the necessary care, removes the pretended experiment from the realms of science to that of dilletantism. Dilletantism may be all very good as a source of amusement, but it must never be considered as science. As Wundt has remarked, "the most dangerous enemy of psychology to-day is not the metaphysical psychology of former days, but the self-sufficient amateurism that considers every aimless toying as a scientific experiment."

Aside from this amateurism there is another deficiency, perhaps of a still more important nature. In the various periodicals we meet accounts of qualitative experiments that might just as well have been made quantitative. Of course qualitative experiments are necessary as preliminary investigations, but they are inexcusable where quantitative ones can be made. That is to say, although they are necessary as forerunners of measurements, and although at certain stages of investigation, they are of incalculable value, yet the scientist must never rest satisfied with them, but should regard them only as stepping-stones for further progress. I can find no better way of stating this than by repeating the words of Sir William Thomson: "I often say when you can measure what you are speaking about, and express it in numbers, you know something about it; but when you cannot measure it, when you cannot express it in numbers, your knowledge is of a meagre and unsatisfactory kind; it may be the beginning of knowledge, but you have scarcely, in your thoughts, advanced to the stage of science, whatever the matter may be" ("Popular Lectures and Addresses," I., 73, London, Macmillan, 1889).

The first step in an investigation is a determination of the relations of dependence between various phenomena; this, however, must give place as soon as possible to a measurement of the changes in the mutually related phenomena. This we can already do to a great extent in regard to mental processes. The degree of accuracy obtainable is in some cases scarce second to that of physical determinations, but in others it falls far below.

The future of psychology, however, lies in the possibility of increasing the accuracy of the measurements of mental phenomena. An advance in accuracy is a difficult thing; but it is of such importance that any sacrifice of time and trouble is justifiable for that purpose. To reduce the error of observations in a given problem by a tenth is a great task, and it becomes greater with each increase in accuracy. Psychology, however, is in the fortunate position of being in possession of methods more accurate than the majority of psychologists are able to apply. Wundt and his followers have gone ahead so rapidly that on the one hand their results can claim an accuracy only one degree less than that of physics, but on the other the psychologists who have never had a training in his laboratory are not quite able to keep up the pace. This, of course, does not apply to those domains of mind not yet subject to measurement. It is very true that there are still large groups of mental phenomena not yet investigated by experiment; we have not yet found a measure for hate, for enthusiasm, or for vertigo. There are still others in regard to which we stand at present just on the point of introducing experimental methods without having achieved anything of great importance; such are the subjects of pleasure, hallucination, the lower senses, etc. Yet again we find those that are fast yielding themselves up to qualitative and even quantitative analyses, e.g., volition in some of its results, the sense of equilibrium, pain (dermal pain quantitatively measured), smell (quantitative measurements by Zwaardemaker and Henry), etc. On the other hand the magnificent achievements in the domain of sight, the good ones in hearing, those in the senses of pressure and temperature, the accurate measurements of visual space, the measurements of the reaction-time, etc., have all tended to place experimental psychology on a high level and to furnish a foundation for a science of psychical measurements, or psychometry.

What is the reason, then, that we are doing second-rate work when we might do first? The trouble lies, it seems to me, in the lack of a proper training. We attempt to make experiments; but how many of us have received a practical training in the use of our apparatus? We make observations; but how many are familiar with the methods of observation and the computation of errors? We obtain tables of results; but how many know how to formulate the equation expressing those results? I know that, until I was brought face to face with the question of what to do with my figures when I had got them, it had not occurred to me to remedy my deficient training by a study of the methods of expressing results. We all of us daily use light, sound, heat, electricity, etc., in our experiments; but how many are familiar with the units and the methods of measuring these forms of energy? What a psychologist must have is a thorough course of training in psychometry, or the methods of psychical measurement.

Summing up, I would say that what we need in experimental psychology is: no quackery, little amateurism, a proper estimation of qualitative work as subordinate, a transformation of the qualitative into quantitative investigations, and, as the means of obtaining all this, a thorough laboratory training. E. W. SCRIPTURE.

Clark University, Worcester, Mass.

THE VESICLES OF SAVI.

IN the *Archives Italiennes de Biologie*, XVI., 1891, page 216, there is a reprint from the *Atti della R. Accad. dei Lincei*, VII., 1891, fasc. 6, of Dr. Alessandro Coggi's important notice of the development of Savi's "*appareil folliculaire nerveux*" in the torpedoes. Since Savi's announcement of his discovery of these peculiar follicles on the lower surface of the torpedo, 1841–44, an extensive series of publications has been made on the subject. The anatomy has received attention at the hands of Boll, Leydig, Kölliker, Max Schultze, Müller, and others; and the nature and functions have been variously determined. Leydig made the vesicles to be one of his three classes of organs for a sixth sense; Wagner supposed them to be electrical excitants; but the majority agreed in regarding them as tactile organs. In 1888, in my work on the "Lateral Canal System of the Selachia and Holocephala," published by the Museum of Comparative Zoology, it was proved that the vesicles belonged to the lateral system, as seen on the skates and sharks, and it was shown that they were not confined to the torpedo, but were found on such genera as Urolophus, Potamotrygon, and Disceus of the rays, where they were simple rudimentary remnants of the lateral canals. My conclusions are amply confirmed by Dr. Coggi from the embryology of torpedo, in the early stages of which he traces the ventral canals, as in embryos and adults of other Selachia. He finds various stages of canal disruption corresponding with those I had figured from the Batoids above mentioned.

Dr. Coggi's assertion that the hypothesis making the vesicles of Savi a special modification of the lateral line system was first brought forward by M'Donnell, 1864, is one to which I should take exception. It must be due to misunderstanding of M'Donnell's statements. That author enumerates five structures that "may be, or have been, confounded with different parts of the lateral line system," and he describes the last one of the five as "The bodies discovered by Savi in the torpedo (*appareil folliculaire nerveux*) — which last, however, may be related to the lateral line, as I shall afterwards attempt to show." This is sufficiently involved to make his meaning very doubtful. But to prove that M'Donnell did not advance the idea of identity of follicles and lateral lines we have only to turn to the penultimate paragraph of his article, where he classes the follicles with other tactile organs, and says that they, one and all, appear to be distinct from the system of the lateral line, which, he says, has more the appearance of a cutaneous excretive organ than of one of sensation (Trans. R. Irish Acad., XXIV., 1864, read 1862, page 161). Up to the present I have learned of no proof or assertion of identity of Savi's follicles and the lateral canal system previous to that in my work of 1888.

Respecting the utility of the follicles it may be added here that my conclusions are at variance with those of all who have heretofore discussed the matter, insomuch that I consider these organs to be practically without special function, and to represent only a transitory condition of the lateral system, intermediate between functional perfection, in the embryo, and ultimate more or less complete disappearance, during the life of the individual. As the organs are absent from particular species or from older individuals, and are rudimentary and irregular when present, this seems to me the only tenable conclusion. S. GARMAN.

Museum of Comparative Zoology,
Cambridge, Mass., Feb. 29.

BACTERIA IN DRINKING WATER.

DR. W. MIGULA (*Centralbl. f. Bakt. und Parasitenk.*, Bd. VIII., No. 12, p. 353) makes a contribution to our knowledge of this subject which is really a new departure as regards the examination of drinking water. He points out that, although considerable stress has been laid on the examination of water for pathogenic organisms, there is no reliable rule to guide the hygienist in his examinations for the ordinary saprophytic organisms and their relation to the purity of water to be used for drinking purposes. Dr. Migula washes out small flasks with bichloride of mercury; then, after rinsing them with the water to be examined, he leaves a specimen in the flask, which is plugged with sterilized cotton wadding and covered with an india-rubber cap. It is not necessary to pack the flasks in ice, as it is assumed that if any of the organisms multiply they will all do so, while if the putrefactive organisms (those that liquefy gelatine) grow more rapidly than the others, independent evidence is obtained of the impurity of the water. Cultivations are made in flat glass dishes in order to save the time required in manipulating plates and tubes during the cooling process. After examining 400 springs, wells, and streams, the author has come to the conclusion that where there are more than ten species in any sample of water, especially when these are not species ordinarily met with, the water should not be used for drinking purposes. He found that in only fifty-nine waters was this the case, but that 169 waters contained more than 1,000 organisms per cubic centimetre, sixty-six of these having over 10,000 (forty over 50,000). From these figures it will be seen that some of the sources of supply would be condemned by the old method but would be passed by the new, and some condemned by the new would be passed by the old. Migula found in all twenty-eight species, and in a series of tables he brings out the fact that the number of colonies does not by any means correspond with the number of species, though in some cases it undoubtedly does so. This is, in fact, an exceedingly variable quantity. It also comes out that putrefactive bacteria are almost invariably absent from spring water; that they are most frequently found where the number of species is great, and where the number of colonies is between 1,000 and 10,000 per cubic centimetre; that they also occur where the number of germs is below fifty per cubic centimetre, but very seldom where the number is over 10,000.

Dr. L. Schmelk, who recently (*Centralbl. f. Bakt. und Parasitenk.*, Bd. IV., No. 7, p. 195) pointed out that there is a great increase in the number of bacteria in the water supply of Christiania during the period that the upland snows are melting most actively, now (*Centralbl. f. Bakt. und Parasitenk.*, Bd., VII., No. 4, p. 102) gives further evidence collected during the last three years in proof of his theory. The numbers he finds for those years were ten or fifteen per cubic centimetre in March to 2,500 in April, 1888; 1,100 in 1889, and on March 28, 1890, 5,000; the breaking up of the winter snows having occurred this year much earlier than usual. This is the period during which the winter snows are melting, and after this is completed there is no marked increase in the number of bacteria in the lake water until the reappearance of the winter snows, some of the earlier falls of which during October, November, and December melt and disappear. In December the number of bacteria per cubic centimetre sometimes reaches 600, the highest point recorded during the year except in March. Dr. Schmelk thinks that the increase is due to the action of frost in breaking up the earth's surface, from which the contained organisms may be set free as soon as a thaw occurs and then washed away along with the surface soil, just as during great rain-storms. He also points out that the masses of ice projecting into a river may form "collecting" points for the particles suspended in the flowing water, as more bacteria are always found in the water obtained from such ice when melted than in the river water itself. He verified this by repeated experiments. He found, however, that when floating ice was melting in water, though it contained a few more organisms than water collected near the surface, it held far fewer than water taken from a considerable depth. In the Christiania water-supply he found some thirty species of bacteria, some of which occurred very seldom, some at certain periods of the year only, and a few all the year round. The amount of solids in the water varies from time to time, between 0.92 and 0.94 grammes per litre, and traces of ammonia can usually be found in water during the time that it contains most bacteria.

THE CHINOOK JARGON.

DURING my visits to the north Pacific coast I became familiar with the Chinook Jargon as spoken in various districts. The jargon is used nowadays most extensively on Puget Sound and in British Columbia, while its use on Columbia River and in the neighboring parts of Oregon and Washington is rather restricted. It has spread as far north as Chilcat and as far south as northern California. The Jargon, as spoken on Puget Sound and farther north, contains a much smaller number of words than the printed vocabularies, a great number of the Chinook words being dropped.

On Columbia River and Shoalwater Bay I found a few additional words belonging to the same dialect of the jargon which was recorded by Horatio Hale and George Gibbs. In recording these words I made use of the same phonetic spelling which has been used in the reports to the British Association for the Advancement of Science on the North-western Tribes of Canada: To accompany, *ā'ᴇc* bone of fish, *pēk'*; to call, *tᴇō'lak;* to carry on back, *tō'itc;* to dream, *mō'sum nā'nitc;* to give food, *ō'ma* (Chihalish); to give present, *k'oē'ᴇn;* grandchild, *kōi'm* (Chihalish); last, *ubō't* (= French au bout?); let us, *hau'ansē;* to make, *qē'lᴇmitl.*

Mamook has acquired an obscene meaning, and is no longer in use on the Columbia River. Muskrat, *tsini'stsinis;* fire is out, *tcqup;* to pursue, *mē'tl'ᴇn*, or *tᴇ'k·s'ᴇn:* to put aside, up, *t'ō'ᴇn;* to rest, *alē'm;* to roast, *p'ᴇ'nis;* robin, *pil k'oatē'n* (= red-belly); to sew, *kyē'pot;* soup, *bō'yō* (French); to stop, *k'a* (Chinook); tail, *tēl* (English); to vomit, *ō'ᴇ.*

One expression which is not found in the published vocabularies, and which is unknown on Columbia River, was obtained on the Siletz Reservation, Oregon: at that time, *kōpa k·oā'ᴇt.* In a few cases the meaning of the words differed somewhat from that given in the vocabularies: to sew, *mamook tipshin* (Hale, "The Oregon Trade Language," p. 60); it means, on Shoalwater Bay and in Clatsop, to mend. To lose the way, *tseepie wayhut* (Hale, p. 60), is not used on Shoalwater Bay, *tseepie* meaning only, to miss an aim. To vomit, *wagh* (Hale, p. 52), not in use in the same region. To tear, *kluh* (Hale, p. 45), means also, to fall.

A number of words which were considered as the sole and original property of the jargon prove to be of Chinook origin: *anah*, exclamation of pain or displeasure; *heehee*, to laugh; *humm*, stinking; *kwehkweh*, mallard duck; *lala*, long time; *liplip*, to boil; *na*, interrogative particle; *nah*, interjection: ho! look here!; *poh*, a puff of breath; *toto*, to shake.

I believe almost all onomatopoëtic words of the jargon are derived from the Chinook. The word *kwaddis*, whale, which is given as a jargon word, is of Tillamook origin. A few other words, the origin of which could not be traced, belong to the lower Chinook: *ekkeh*, brother-in-law; *kelapi*, to turn; *tukwilla*, nuts. Two words, which have been derived from English, are more probably of Chinook origin: *till*, tired (*tᴇl* in Chinook); *spose*, if, which is generally derived from "suppose," but is more frequently pronounced *pōs* on Columbia River. *Pōs* means in Chinook, if; so that *spose* may be explained as due to folk-etymology on the part of the traders, or *pōs* as folk-etymology on the part of the Chinook.

It is of interest to note that two Nootka words which are found in the jargon have very close analoga in Chinook: *chuck*, water (*tltcuk* in Chinook); *wawa*, to speak (*awā'wa* in Chinook). A number of Chinook terms which have been embodied in the jargon have become extinct in Chinook proper. This is due to the fact that they have been dropped after the death of persons whose names resembled these words: *tmē'maluct* (jargon, *mimaloose*) is now *tᴇmēuwa'lᴇma;* *it'amā'noac* (jargon, *tamahnowus*) is now *iō'tlema.* FRANZ BOAS.

Worcester, Mass., February.

NOTES AND NEWS.

EXPERIMENTAL psychology can count four new laboratories among its acquisitions during the present academic year, those that have been or are about to be established at Heidelberg (Germany), Geneva (Switzerland), Cornell (New York), and the Catholic University (Washington).

— The Oriental Club of Philadelphia was organized in 1888 with Professor Herman V. Hilfrecht as president, Professor M. W. Easton, treasurer, and Stuart Culin, secretary. It has held regular monthly meetings since that time, at which formal papers were read and discussed. The membership of the club is limited to thirty, and now numbers twenty-five, including Professor Paul Haupt and Dr. Cyrus Adler of Johns Hopkins University, Professors Barton, Hopkins, and Collitz of Bryn Mawr College; Professors Jastrow, Easton, Hilfrecht, Brinton, and Peters of the University of Pennsylvania, the Rev. Dr. Morris Jastrow, and others, it being strictly confined to oriental scholars.

— At the February meeting of the Oriental Club of Philadelphia, Mrs. Cornelius Stevenson read a paper on "Two Ancient Forms of Religious Symbolism, the Stone Axe and the Flying Sun-Disc." "The stone axe," the speaker said, "is the weapon of the power above. It is the bolt flung from heaven in the lightning, and which was thought to contain a spark of the heavenly fire. In pre-historic archæology, the wielder of the bolt is generally represented under the shape of a bird, which, according to the development of the people, is either the embodiment or the messenger of the ruling spirit of heaven. In Egypt, with the development of sun-worship, the Halvk of Horus, the embodiment of the upper space, in the course of time was represented as entering the sun, which is spoken of as the 'body' in which the divine spirit dwells, and which, in the form of the Horus of Edfu, as the flying sun-disc, becomes the 'heavenly Striker.'"

— The Museum of Archæology and Palæontology of the University of Pennsylvania has been reorganized as a department of the university by the trustees, under the direction of a Board of Managers, of whom thirty are appointed by the University Archæological Association, and six by the trustees of the university. This action has been found necessary through the rapid extension of the collections and increased interest in the work. The museum is divided into four sections, American, Babylonian, Egyptian, and Oriental, each in charge of a special curator. The University Archæological Association, by whose efforts the collections were brought together, defrays all expenses. It now numbers about three hundred contributing members. Mr. Charlemagne Lowe is president of the department, and Dr. William Pepper, the provost, is president of the association.

— In his Shattuck lecture Dr. Cowles sums up the symptoms and the treatment of neurasthenia as follows: the central fundamental fact is nervous weakness, manifested primarily in two ways: (1) by an exactly parallel weakness of mental inhibitory control through voluntary attention, and (2) by the central motive element of a lowered emotional tone, from a sense of ill-being. The first of these indications may be concealed, even from the patient himself, by intensified interest and increase of effort; the second he feels and soon betrays. The complex auxiliary conditions of changes in the sensations, irritability and hyperæsthesia, languor and anæsthesia, and their causes, are manifested a little later than the primary mental effects. The point of attack in the treatment is the central emotional tone. There are two ways of approach to it: (1) through the body, restoring its strength and well-being, mental comfort and control follow; (2) through attracted attention and suggested ideas we reach the emotional tone, — healthful feeling and interest attend upon wholesome ideas.

— The Museum of Archæology of the University of Pennsylvania has just received from the Egypt Exploration Fund a colossal statue of Rameses II, which has been set up in the hall of the Library Building. The statue, which is eight feet in height, was found among the ruins of the Great Temple at Har-shefi (Hanls), the herakleopolis of the Greeks, during the excavations undertaken by the Egypt Exploration Fund, under the supervision of Mr. E. Naville in the winter of 1891. Hanls was the seat of government during the ninth and tenth dynasties of Mantheo (fourth millennium B.C.), as shown by the corroborative evidence of inscriptions found in contemporary tombs at Siût. Unfortunately, no remains of the older buildings were found, and the earliest dated fragments uncovered date from the twelfth dynasty, and even these were few. The temple was rebuilt by Rameses II., and this monument formed part of this later edifice (Ca. B.C. 1330). According to the curator, Mrs. Cornelius Stevenson, the hieroglyphs cut in the back and sides of the royal seat give the king's name and titles: the crowned "Horus," the "Mighty Bull," "Beloved of Amon," or "Maat," or "Ptah," or "Ra," or "Knum;" "Son of Rā," "Ramessu Meri Amon," "Chosen by Rā," "Lord of the two Sands," "Lord of Diadems," "Giving Life like Rā," etc.

— The committee appointed last September by the American Association for the Advancement of Science to raise the sum of five hundred dollars for the continuance, during the year 1892, of the American table at the Naples station, take pleasure in announcing to the American scientists that through the liberality of the American Association, the University of Indiana, the Association of American Naturalists, Professor C. O Whitman of Clark University, and Major Alexander Henry Davis of Syracuse, N.Y., the necessary sum of money has been subscribed, and the table is now at the disposal of the American biologists. Applications for the privilege of working at the station should be addressed to the committee, care of C. W. Stiles, Ph.D., Bureau of Animal Industry, United States Department of Agriculture, Washington, D.C.; or, should any American biologist in Europe not have time to communicate with the committee, application may be made to Geheimrath A. Dohrn, director of the zoological station, Naples, Italy. Scientific journals throughout the United States please copy.

— *The American Journal of Psychology* is about to make a slight change in its editorship; beginning with the next number E. W. Scripture, Ph.D. (Leipzig) is to be associated with President Hall.

— The experiment station of Cornell University has conducted three experiments carried through as many seasons, for the purpose of determining whether it is profitable to feed grain to cows when on good pasture. The first two experiments were made at the station, on lots of three cows each, the cows being in good condition and running on good pasture. As some objection was raised against this test on the ground that the pastures used were too rich and the cows too well fed to show the best results from grain feeding in the summer time, the experiment of 1891 was transferred to a herd of sixteen Jerseys and Jersey grades, belonging to Messrs. C. M. and W. L. Bean of McGrawville, N.Y. This herd had been accustomed to only a moderate grain ration in winter and never had any grain in summer. This herd was divided into two lots of eight cows each, the division being made by the station on the basis of weight, length of time in milk, length of time in calf, yield of milk per day and per cent of fat in milk, and was indorsed by the owners of the herd in the opinion that "the cows were as evenly divided as it was possible for them to be." The experiment continued from May 23 to Oct. 23, or twenty-two weeks. One lot of cows received each day four quarts of a mixture of two parts corn meal, one part bran, and one part cotton-seed meal by weight, fed in two feeds, night and morning, when the cows were brought in to be milked. The general results of the three years' experiments are summarized as follows: In 1889, in a season in which the pasturage was very luxuriant throughout the whole summer, with three cows in each lot, the grain-fed lot gave considerably less milk, which was so much richer in butter fat, that the total butter production was practically the same in the two lots. In this experiment the grain feeding was commenced about a month after the cows had gone to pasture. In 1890, in a season in which the pasturage was luxuriant, except for a short time in the middle of the summer, with three cows in each lot, the total amount of butter-fat produced was almost exactly the same in both lots. In this experiment the grain-fed lot continued to receive the same ration on pasture that they have been receiving during the winter on dry feed. In 1890, in an experiment on soiling with grass alone, with grass and grain, just about enough more butter was produced by the grain feed to pay for the increased cost of the grain ration. In 1891, in a season in which at no time the pasture was very luxuriant, with eight cows in each lot, the grain-fed lot produced just enough more milk and butter to pay for the increased cost of the grain ration. In this experiment the grain feeding was begun about two weeks after the cows went to pasture.

— The first lecture, on the religions of Egypt, in the University of Pennsylvania Lecture Association's course on "Ancient Religions," was delivered by Mrs. Cornelius Stevenson, at Association Hall, on the afternoon of Feb. 25. The title of this introductory lecture was "Primitive Egypt and its Relation to the Stone Age." It was prefaced with a general geographical description of the country, special notice being taken of the changes it has undergone since the opening of the historical period. The lecturer dwelt at length on the various theories concerning Egyptian origins, and on the originality of Egyptian culture, whose earliest seat was in Upper Egypt. Among the interesting survivals from prehistoric times are the stone implements, from which can be derived a notion of primeval ideas and customs. The first traces of religious awakening are betrayed in the cave-burial and the care of the departed. The problem of his present life and its mysterious cessation with death first made man think of spiritual things, and, from the sense of immortality which he felt in himself, led him to conclude upon a certain immortality of the soul, or survival of the spirit. Hence the various food-offerings to the dead, because the spirit was supposed to revisit the body as long as it was not decayed, and the tomb was looked upon as the habitation of the dead. Similar ideas are found among the oldest vestiges of man in western Europe, in the caves of the neolithic period.

— Dr. A. Woeikof of St. Petersburg, who is engaged on an investigation into the cause of the famine in Russia, says *Nature*, writes that it is chiefly due to drought from August to October, 1890, which injured the winter crops; to partial and insufficient snow, which melted early in the spring, and was followed by frost in April; and lastly to droughts and hot winds from May to July, 1891. In the southern portion of the Government of Samara the prospects up to June 10 were excellent, but the harvest was destroyed by two days of hot winds, on June 14 and 15. And in the southern central provinces also, where the winter crops had greatly suffered, a moderate harvest was hoped for after the middle of July, but four hot days, from July 13 to 16, quite destroyed the crops.

— The number of persons who approve of cremation seems to be steadily increasing, according to *Nature*. From the report of the Cremation Society of England for 1891, we learn that in 1885, the first year the crematorium at Woking was used, only 3 bodies were sent there; in 1886 the number was 10; in 1887, 13; in 1888, 28; in 1889, 46; in 1890, 54; and during the past year, 99. Crematoria are being built in various parts of the country. At Manchester a crematorium is in course of erection, and will, it is thought, be completed and opened for use during the coming spring. A company has also been formed, and is making rapid progress, with the same object at Liverpool; and the City of London Commission of Sewers is taking steps to obtain powers to erect a crematorium at their cemetery at Ilford. The Cremation Society at Darlington, and other associations, are moving in the same direction.

— The Journal of the Scottish Meteorological Society (third series, No. 8) contains a very interesting paper on silver thaw at Ben Nevis Observatory, by R. C. Mossman. The phenomenon is somewhat common at that observatory, and occurs during an inversion of the ordinary temperature conditions, the temperature being considerably lower at the surface than at higher altitudes, causing the rain to congeal as it falls. In the six years 1885-90, 198 cases of silver thaw were observed, with a mean duration of 4½ hours in each case, and they nearly all occurred between November and March, during times of perfectly developed cyclones and anticyclones. An examination of the weather charts of the Meteorological Office showed that for the 198 days on which the phenomenon was observed the distribution of pressure was cyclonic on 137 days, and anticyclonic on 61 days. In anticyclonic conditions there was a cyclonic area central off the north-west coast of Norway, while the centre of the anticyclone was over the south of the British Isles. In cyclonic cases, an anticyclone lay to the south, over the Iberian Peninsula. The lowest temperature at which the phenomenon took place was 18°, and was rarely below 27°. Fully 90 per cent of the cases occurred when the thermometer was between 28° and 31.9°, so that the greater number of cases occurred just before a thaw. The most common type of cloud which preceded both cyclonic and anticyclonic cases of silver thaw was cirro-cumulus, frequently accompanied by cirrus and cirro stratus; and the changes showed that the higher strata of the atmosphere came first under the influence of the moist current, which took from three to eight hours to descend to the height at which cumulo-stratus forms. An examination of a series of storm charts prepared by Dr. Buchan disclosed the somewhat remarkable fact that 73 per cent of the cyclonic and 63 per cent of the anticyclonic cases of silver thaw on Ben Nevis were followed or preceded by gales on our northern and north-western coasts; and it would appear from the wind conditions that the barometric gradient at the height of Ben Nevis (4,407 feet) must be totally different from what obtained at sea-level during the occurrence of silver thaw on the hill-top, says *Nature*.

— There has been much talk in Germany about Dr. Peters's discovery of saltpetre in the Kilima Njaro district. This discovery accords with statements which were already well known. Dr. Fischer, after an examination of the Donjongai volcano, reported that in the neighborhood of the crater there were a series of curiously-shaped veins of a white substance which he took to be either saltpetre or soda. In 1879 Herr Jarler asserted that large quantities of sulphur would probably be found in the crater. The Berlin correspondent of the *Times*, by whom these facts are noted, adds that not far from the volcano there lie great swamps from which soda is obtained. It is expected that an expedition for the exploration of the district will soon be sent out by the German East Africa Company.

— It is well known that yellow-fever never develops in a cold or temperate climate, and several attempts have been made at various times to apply this fact to the treatment of the disease in tropical climates by artificially cooling the patient. Thus some thirty-five years ago trials were made with a cold chamber, the air of which was charged with oxygen, but without appreciable success. Quite recently Dr. Garcia has reintroduced a somewhat similar plan, an iced chamber being constructed so that the air within should be maintained at a temperature varying from 32° to 50° F., and nearly saturated with moisture. A fair trial was made with this at the works of the Juragua Iron Company in Cuba, where an epidemic of yellow-fever had broken out, seventeen well-marked cases, in all of which black vomit was present, being treated by means of the "polar chamber." Eleven of them recovered, the mortality consequently being at the rate of 35.3 per cent, or about the same as the usual rate of mortality at the mines under other methods of treatment. The course of duration of the disease did not appear to be in any way modified by the low temperature; the urine, though in some cases considerably increased, was not altered qualitatively. The phenomena depending on acholia occurred in the same manner and at the same period as in cases treated in the ordinary way. The same may be said of the gastric hæmorrhage. The cost of a patient's treatment by cold was found to amount to about $100, says *Lancet*.

— The sixteenth annual commencement of Meharry Medical Department of Central Tennessee College was held at Nashville, Tenn., Feb. 18. Twenty-five young men received the degree of M.D., one that of D.D.S, and three were awarded diplomas for having completed the course in pharmacy. G. W. Miller of South Carolina delivered the salutatory address, on "Practical Bacteriology." He gave an account of the different kinds of bacteria, how they could be cultivated, stained, and examined, and how one variety could be distinguished from another. The pharmaceutical class was represented by Robert Tyler of Mississippi, who gave an address on "The Relations between Physicians and Pharmacists." The valedictory address was given by J. W. Holmes of Texas, his subject being "The Advance of Modern Surgery." The speaker referred to the early history of surgery, especially that practised by the Egyptians and Grecians. He spoke of the reforms in surgery and the leaders in these reforms, the principal operations of importance from the sixteenth to the present century inclusive, and of some of the appliances which had accomplished much for surgery, such as anæsthetics and antiseptics. He also gave elaborate descriptions of cranial and abdominal surgery, mentioning some of the most hazardous operations performed in these cavities, and also paid a high tribute to the modern surgeon for the achievements accomplished by him. The past year has been the most successful and encouraging ever known in the history of this school, the number of students and graduates being about fifty per cent greater than that of any previous session, one hundred and eighteen medical, and seven dental and nine pharmaceutical students being enrolled. The record of the alumni of Meharry Medical College has been most gratifying. Of those who have graduated within the past six years only two have failed to pass the required examination before the "Boards of Medical Examiners," standing equal with the white applicants from the different medical colleges of the South, with whom they were examined at the same time, and have been well received by the white physicians.

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MOTION AND HEAT.

The term "Mechanical Equivalent of Heat" does not present a perfectly accurate concept of the determinations of Dr. Joule and others. The great work actually done was the determination of the "Heat Equivalent of Molar Motion."

"The Mechanical Equivalent of Molar Motion" is the amount of mechanical work that it will do; and when the whole energy embodied in a given molar motion is converted into heat, the units of heat thus developed may again be converted into molar motion capable of doing the same work. Hence the term "Mechanical Equivalent of Heat" is accurate enough for purposes of calculation.

But the true equation is that molar motion is equivalent to so much mechanical work; molar motion may be converted into heat capable of the same amount of mechanical work that the molar motion could do before its conversion into heat, and therefore we have the "Mechanical Equivalent of Heat." This use of the consequence, that is, the mechanical work which molar motion can do, for the motion itself, tends to obscure the concept of the real relation between heat and molar motion.

The primal work of the energy, or force, which constitutes molar motion is to transfer a mass from one place, or part of space, to another, and so long as this work is continued and unresisted, no heat is developed. A body moving through space entirely unresisted, whatever may be its mass or velocity, develops no heat. It is only when the movement is resisted by impact or friction of some kind that the energy of motion assumes the form of heat; and it is only when thus resisted that this energy of motion can do mechanical work. To the extent that the energy embodied in resisted molar motion is expended in mechanical work it cannot be converted into heat.

Mechanical work consists in counteracting some other force, generally gravitation or cohesion. The force or energy embodied in a ball thrown upwards from the earth's surface develops no heat except such as may result from the friction of the air; and if at its precise point of highest elevation it lodges on the top of a house or some other support, none of the energy is thereby converted into heat. The ball has acquired what Mr. Balfour Stewart calls energy of position; and when this potential energy again becomes dynamic by the ball's falling to the earth, no heat is developed except by the friction of the atmosphere, until the ball strikes the surface of the earth. If the phenomena occurred in vacuum neither the energy of motion in the ball, while doing the work of lifting the ball to its highest elevation, thus counteracting gravity, nor the potential energy rendered dynamic by its fall, would develop any heat whatever until its impact against the earth's surface. Here, according to the law of conservation of energy, it would do work or develop heat equivalent to that expended in its upward projection.

But to the extent that the energy of the impact itself does mechanical work, that is, counteracts cohesion in the work of molar deformation, it develops no heat. If an egg and a metal ball of the same shape, size, and weight are dropped from the same height on a hard pavement, the heat developed by the two impacts cannot be the same if the egg is smashed. If the heat developed by the impact of the metal ball is X, that developed by the impact of the egg must be X minus the kinetic energy required to smash the egg.

One of the occupations of my boyhood was to attend a mill for grinding corn, and one of the first things learned in that business was that if the moving stone was properly balanced and a sufficiency of corn supplied, the meal came out very little heated; but if the stones came into contact from lack of having corn to grind or from want of proper adjustment or levelling of the moving stone, heat was developed rapidly.

It is for this reason that hard substances like flint and steel more readily develop by friction the heat necessary for combustion than softer substances; the energy of motion in the friction of softer substances is expended to a greater or less extent in molar deformation, and it is only the residue not thus expended that is available for conversion into heat.

This principle is constantly applied in practical mechanics to develop heat from friction when it is required, and to prevent its development when not wanted. Except for igniting combustibles, heat from friction is not generally wanted for practical use; but Dr. Mayer mentions an instance in which a manufactory used a surplus of water power to revolve two large iron disks against each other to develop heat by friction to warm the establishment. The very general object in mechanical work is to prevent the conversion of the energy of motion into heat by friction, and this is done both by diminishing the frictional resistance, and also by the use of solid lubricants whose molar deformation will furnish work for the energy unavoidably lost in friction, and thus prevent the development of heat and the local injury from the energy in that form.

Hence it was that Dr. Joule and others, in making the determinations of the so-called "Mechanical Equivalent of Heat," made use of substances in which there was no work or very little work of molar deformation for the energy, the heat equivalent of which was measured.

It seems, therefore, that two propositions may be stated:—

First, that molar energy, that is, the kinetic energy of a moving mass without friction, develops no heat while doing its primal work of transferring the mass from one place, or part of space, to another.

Second, that when the movement of the mass is resisted, the heat developed is the equivalent of only so much of its energy as is not expended in molar deformation or other mechanical work.

There is obviously another cause which may prevent the kinetic energy of molar motion from development into heat, and that is its conversion into the molecular motion of expansion. When expansion occurs, there is necessarily an enlargement of the intermolecular spaces or of the molecules themselves, or a movement of the molecules; and while we have as yet no such demonstration as is possible in molar phenomena, we can assert, without fear of scientific denial, that the phenomenon of expansion is a manifestation of molecular motion.

It is usual to regard expansion as the work of heat, and it is undoubtedly the work of the same energy which is embodied in molar motion, and which causes an elevation of temperature; which passes from one body to another by conduction, and from one body to another and from bodies into space by radiation.

But this energy, while doing the work of molecular motion in expansion, develops no more heat than while it is moving an unimpeded mass through space. The impact of moving masses free to expand from the instant of impact could develop no perceptible heat; that is, only so much of the energy as was not expended in the work of molecular motion of expansion would be available for the development of heat. If the bodies brought into impact were liquid ammonia, and this was set free in the atmosphere by the impact, not only the entire energy of the impact (unless the molar motion was almost beyond calculable velocity) would be expended in the work of expansion, but energy in the form of heat would be withdrawn from surrounding bodies to finish the work.

It is resistance to the molecular motion of expansion that develops heat when expansion occurs as the primal work, that is, which causes an elevation of temperature, and converts the energy or force into the other well-known phenomena of heat.

This resistance may be from cohesion in the matter to which the energy or force is imparted, from chemical affinity, from the walls of a containing vessel or other environment, or from a piston or other compression. In every case the development of heat, that is, the elevation of temperature, and the other phenomena indicating the conversion of the force or energy into the form of heat, is determined by the intensity of the molecular motion set up by the force or energy imparted to the body, and the resistance to it.

Hence, in the experiments to determine the so-called "Mechanical Equivalent of Heat" where expansion was used, means were provided for its perfect resistance. Here again the term does not express an accurate concept of the determination actually made; it was really the "Heat Equivalent of Molecular Motion." As in the other case, the expression is accurate enough for purposes of calculation, because the mechanical equivalent of molecular motion, that is, the mechanical work it will do, is the same as the mechanical equivalent of the heat developed by its perfect resistance.

It is not the motion in either case that is converted into heat, but it is the force or energy causing the motion which ceases to move the mass or molecules and causes an elevation of temperature and the other phenomena of heat.

It seems, therefore, that we can state two other propositions, namely:

Third, that so much of molar motion as is converted into molecular motion by impact or friction cannot be directly converted into heat; and,

Fourth, that the molecular motion set up by molar impact, friction, or otherwise, and manifested by expansion, can be converted into heat only by resistance to expansion.

This force, or energy, is dynamic when causing motion or when causing elevation of temperature and the other phenomena of heat; but it becomes potential, or "energy of position," when a ball is thrown up and lodged on the roof of a house, or when radiant and dynamic heat becomes the latent heat of liquefaction and evaporation, or when the dynamic radiation from the sun is stored up in the molecular structure of the hydro-carbons of vegetable and animal organisms by chemical affinity and the vital forces; and it becomes partly potential when heat is absorbed.

This force, or energy, is directly subject to observation only when dynamic; it apparently disappears when a ball thrown up lodges on the roof of a house, or when heat becomes latent in liquefaction and evaporation, and when heat and light are stored up in the molecular structure of vegetable organisms. But we know that by appropriate means it can be rendered again dynamic, with its full integrity and with the qualities it possessed before its imprisonment, including the equivalence of its different forms. It becomes dynamic in the form in which it was rendered potential; in the ball loosed from its perch the energy becomes dynamic as molar motion; in liquids and gases subjected to pressure the latent heat of liquefaction and evaporation becomes again dynamic as heat; and in the combustion of vegetable organisms the sun's energy becomes again dynamic substantially as it was locked up.

Light is undoubtedly a division of the heat form of this force, or energy. It is rendered potential in vegetable organisms, and becomes dynamic as heat, not as light, when the combustion of the organism occurs slowly and at a low temperature. It not only results from intense heat, but Professor Tyndall has demonstrated that heat rays, after they leave the body which sends them forth, may be concentrated into light rays. It will therefore be sufficiently accurate for our present purpose to consider both heat and light as together constituting a single form of this force, or energy.

If expansion is resisted by cohesion, chemical affinity, mechanical pressure, or otherwise, the temperature of the body rises in proportion to the increments of the force, or energy, received; radiation increases with rise of temperature, and if the resistance is sufficient, incandescence and the more intense radiation in the form of light, begin.

It may be impossible from lack of power in any machine which man can construct to compel by compression of expanded matter incandescent radiation. But when heat becomes radiant as it does from compression, it is only a question of intensity whether the matter radiating heat will become red hot and radiate light also.

In the combustion of hydrocarbons it is evidently the resistance to expansion which causes heat radiation, and as this resistance becomes more intense, light radiation also. In the vegetable or animal organisms which constitute the hydrocarbons a new molecular structure has been built up, in which force, or energy, coming dynamic from the sun has been stored up and rendered as completely potential as the energy of a ball lodged on the roof of a house, or as dynamic heat when it becomes the latent heat of liquefaction or evaporation. This force, or energy, thus stored up by chemical and vital action in the new molecular structure and rendered potential, is set free and again rendered dynamic by the chemical reaction of combustion, and the material elements return substantially to the condition in which they were before.

The force, or energy, thus set free by the chemical reaction at once begins the work of dynamic energy; and if the matter in which the reaction occurs is free to expand, the energy is expended in the molecular motion evidenced by expansion.

But if expansion is resisted by cohesion, chemical affinity, or mechanical compression, there is an elevation of temperature and the other phenomena of heat.

As resistance to expansion increases, heat becomes more intense; and when heat radiation is unable to carry off the energy as rapidly as it is set free, the matter becomes incandescent, and the more intense form of light radiation begins.

The graphic description of ordinary combustion in Dr. Josiah P. Cooke's "New Chemistry" leaves no doubt that this is what actually occurs, and that "the light comes from the incandescent solid particles," because they are more persistent in resistance to the molecular motion evidenced by expansion. The moment these particles are converted into carbonic dioxide, and aqueous vapor, and thus become free to expand, the matter ceases to be incandescent.

If we could provide some means in ordinary combustion for retaining the carbonic dioxide and aqueous vapor, with the molecules concentrated as they are in the carbon particles, the matter would doubtless continue incandescent after the reaction; and undoubtedly the energy expended in the expansion of the carbon dioxide and aqueous vapor, could be converted into radiant heat by sufficient compression of those gases.

The phenomena of explosions demonstrate even more clearly than ordinary combustion that the development of heat results from resistance to molecular motion. Loose gun-cotton exploded, will not develop heat sufficient to ignite gun-powder in contact with it; but if the gun-cotton is confined, its combustion develops heat sufficient to ignite gunpowder, and substances far more refractory. It is said that the reason for this peculiar result of the explosion of loose gun-cotton, is that there is not time to develop the heat. But the true reason undoubtedly is that the molecular motion set up is so intense, as compared to the resistance of the atmosphere, that the entire force or energy of the explosion is expended in that work, and there is little or no necessity for elevation of temperature or radiation.

In firing a gun, the energy developed by the explosion is divided into three parts: that which by reason of resistance to molecular motion causes elevation of temperature and radiation in the barrel; that which imparts molar motion to the projectile (which we know may also be converted into heat); and, third, the residue of molecular motion which is dissipated in the atmosphere at the muzzle of the gun, and neither develops heat in the barrel nor adds to the molar motion of the projectile.

If the foregoing inductions are sound, the heat developed by an explosion is determined by the resistance to the molecular motion exerted by the force or energy set free and rendered dynamic by the chemical reaction. This resistance consists of cohesion and chemical affinity in the matter in which the reaction occurs, and in the environment. If the whole force or energy set free and rendered dynamic is d, and the whole resistance is r, and x the units of heat developed, then $x = \frac{d}{r}$.

This explains why the attempts made to determine the energy of explosives by the units of heat developed in their explosion have resulted in unmitigated nonsense.[1]

This has doubtless been a source of error in determining the heat evolved or absorbed in chemical processes. The energy converted into heat by resistance to molecular motion, and afterwards lost by radiation or conduction, is estimated or otherwise taken into the account, but that which slips away in the form of unresisted molecular motion is not counted.

"Although these values," says Dr. Cooke in his "Chemical Philosophy," "are undoubtedly as fundamental constants of chemistry as the atomic weights, yet they have not been as yet so fully confirmed or so thoroughly collated as to enable us to present an entirely consistent system. Hence the table here given [of heat evolved or absorbed in different chemical actions] must be regarded as provisional, and as serving only to illustrate the principles of the subject.[2]

It is not necessary to the present inductions to determine whether the molecular motion evidenced by expansion, and which, when resisted, results in elevation of temperature and other phenomena of heat, is molecular vibration as supposed in the kinetic theory, or a rectilinear projection of the molecules, as I have tried to prove.[3] All we need to know is that this molecular motion, whatever may be its character or direction, is work done, and, as in the case of molar motion, the energy embodied in it cannot be converted into heat except by resistance.

Elevation of temperature, which is the first phenomenon of heat, seems to be a preparation for the flight of radiation, the flight becoming more rapid or intense as the temperature rises; but energy will not make the preparation nor begin the flight from the matter in which it is embodied, unless its work of molar or molecular motion is resisted or hindered.

Whether heat absorbed by matter is energy rendered partially potential by the partial counteraction of cohesion, or whether it continues fully dynamic in the work of increased molecular vibration as supposed in the kinetic theory, it is not necessary for our present purpose to determine. We know certainly that heat is absorbed by matter, and the phenomena of the atmosphere demonstrate that the capacity of matter to absorb heat diminishes by some as yet undetermined ratio with increase of tenuity. This diminution of capacity to absorb heat doubtless results from the smaller number of molecules to which motion can be imparted; and taken in connection with the induction that energy becomes radiant as heat and light when molecular motion is resisted, or hindered, it furnishes a very simple explanation of the intense heat and brilliant incandescence which small increments of energy develop in highly exhausted tubes.

The work of molecular motion being restricted by the paucity of the molecules, the small increments of energy, finding no sufficient work in moving them, elevation of temperature and incandescence follow, for substantially the same reason as in other cases where greater increments of energy are applied.

It seems to make no specific difference whether the increments of energy are imparted by the direct conduction or radiation of heat, or by resistance to a current of electricity.

Mr. Crookes, by concentrating increments of energy in a highly exhausted tube on iridio-platinum alloy, one of the most refractory metallic compounds, not only raised it to a white heat, but actually melted it: while the same measurable increments of energy applied to the same substance in the atmosphere, or in some other medium not more tenuous, would have caused hardly an appreciable elevation of temperature. The energy, in such case, would be expended in

[1] The true measure of the energy of explosions must be the amount of energy set free by the chemical reaction, and this is determined by the number of molecules put in motion (quantity of matter, etc.) and their velocity.

[2] "Chemical Philosophy," revised edition (1891), p. 174.

[3] "Molecular Motion in the Radiometer," etc. N. D. C. Hodges, New York, 1891.

molecular motion in the surrounding medium. And the brilliant incandescence in Geissler, Crookes, and Tyndall tubes from minute increments of energy are well known.

This increase of temperature and radiation from small increments of energy in highly tenuous matter seems to be what we ought to expect from the phenomena of this force or energy when it is in the form of molar motion. We then measure it by the mass and velocity of the moving body; that is, by its momentum, and this momentum is what is convertible into heat when the movement is resisted.

Increase in velocity compensates for decrease in mass, and hence a small projectile, at high velocity, will do the same work as a larger projectile at lower velocity; and the momentum, in each case, can be converted into the same units of heat. For obviously the same reason, the intense velocity imparted to the gaseous products of an explosion of dynamite enables this highly tenuous matter to do precisely the same work on a hard rock, as a hammer of a million times the mass, but moving with only one-millionth of the velocity.

But there is necessarily a limit to this substitution of velocity for mass; and this limit is in the capacity of matter to embody the energy; and when the force of energy is applied to matter in the form of heat we ought to expect to find the same limit. This application in the form of heat may be made by conduction, when the whole energy imparted is absorbed; or by radiation when only so much as is not reflected, is absorbed; but the resulting phenomena are the same, whatever may be the process by which the absorption is accomplished.

The fact developed in spectrum analysis, that incandescent matter absorbs the same rays of light which it emits, seems to be another illustration of the law that the capacity of matter to receive radiant energy is limited, and in this case by its capacity to radiate the energy received.

If the evolution of heat and elevation of temperature results from resisted molecular motion, it necessarily follows, that a single molecule, moving in unconfined space, whatever may be its velocity, would be at the absolute zero of temperature. But this is mere speculation of no scientific value, because we have no evidence that a molecule can become separated from other molecules, nor that it is possible to place it where it could move without resistance.

But there is another induction of practical importance in sustaining the assumption that we have just made. If the effect of heat imparted to matter by conduction or radiation is to set up the molecular motion evidenced by expansion, and this work of molecular motion must be resisted before radiation begins, it necessarily follows that the number of molecules in the body receiving heat, and to which motion can be imparted; in other words, the density of tenuity of the matter, must be an element, determining, in some measure, the capacity of the matter to absorb heat.

This explains why the atmosphere decreases in temperature with increase of tenuity, upwards from the earth's surface; and why we can assume absolute zero in space entirely unoccupied by ponderable matter, if there is any space thus entirely unoccupied, notwithstanding the presence of potential or dynamic energy, because it is only in conjunction with ponderable matter (resisted molar or molecular motion) that dynamic energy develops elevation of temperature, and the other phenomena of heat.

It is obvious that force or energy in the form of molar motion is being constantly converted by impact or friction into the form of heat. Taking the earth as a whole, during the period of human observation, this constant conversion of molar motion into heat has been compensated by a conversion of heat into molar motion, so that the equilibrium between the two forms of this force or energy has been preserved in terrestrial nature, and there has been no loss of motion nor increase of heat, since man began to observe nature and keep a record of his observations.

Resistance to movement, that is, to the work being done by the force or energy in molar motion, is necessary to convert the force or energy into the form of heat; and it may be that when this force of energy is applied to ponderable matter in the form of heat, and its proper work as heat is resisted, the surplus heat may be converted directly into molar motion.

It is certainly within the range of possibility, that, under certain conditions, a body of ponderable matter may receive increments of heat more rapidly than it can furnish work for it in the molecular motion of expansion, or discharge it by radiation or conduction; and, in such case, it seems inevitable that the body thus receiving more heat than it could furnish work for or discharge, if free to move, would be put in motion away from the source of heat, and that this motion would continue until a distance from the source of heat was reached, at which the heat received was not greater than could be employed in expansion or discharged in radiation and conduction.

Dr. Grove was inclined to the opinion that it was thus possible to convert heat directly into molar motion. He says, "There are, indeed, some delicate experiments which tend to prove that a repulsive action between separate masses is produced by heat. Fresnel found that mobile bodies heated in an exhausted receiver repelled each other to sensible distances; and Baden Powell found that the colored rings, usually called Newton's rings, change their breadth and position, when the glasses between which they appear are heated, in a manner which showed that the glasses repelled each other."[1]

But, however that may be, there is certainly a molar motion which always follows and evidences the molecular motion of expansion. The law that action and reaction must be equal and opposite, applies to molecular motion in a closed vessel. It is the operation of this law which secures uniform pressure in steam boilers, and other like devices for using gas expansion for mechanical purposes; and thus converts the molecular motion, evidenced by expansion, into molar motion.

DANIEL S. TROY.

(To be continued.)

[1] "Correlation and Conservation of Forces," p. 41. D. Appleton & Co. 1890.

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.*
On request in advance, one hundred copies of the number containing his communication will be furnished free to any correspondent.
The editor will be glad to publish any queries consonant with the character of the journal.

A Question in Physics.

CAN there be a crowding of the particles of a gas to a much smaller compass without its being markedly heated? Can a gas expand without being cooled? At first thought the answer would seem to be an emphatic *no* in both cases; but it would appear that these conditions may exist sometimes. *Science*, Vol. XV., p. 387, published the results obtained by direct determination of the heating of air when compressed by a pump connected by a long tube with the cylinder. A compression to ten inches above atmospheric pressure gave a heating of about 4° F., ignoring the heat lost to the sides of the cylinder. The corresponding expansion into the open air gave a cooling of about 4°, neglecting the heating effect of the cylinder. These results were strongly combated by Professor Ferrel in *Science*, Vol. XVI., pp. 192 and 193, and also by Professor Marvin. Professor Ferrel published the well-known thermo-dynamic formula, given in *Science* for Feb. 19, and applying it to the heating in the above case found it 43° F. instead of the 4° found by the experiment. It would seem, however, that these experiments had not been controverted, and it is probable that their justness may yet be established This problem is far-reaching in its application, and it is for this reason that it is dwelt upon at some length.

The formula given by Professor Ferrel applies only in cases where a gas is compressed directly by an external force, and when all the heat developed in the work of compression is concentrated in the gas. One of Joule's experiments will serve to elucidate this point. He determined the mechanical equivalent of heat by immersing the cylinder into which the air was to be compressed and the compressing pump in the same water bath, and then determining the amount of compression and the total heat developed. This shows at once the truth of the following proposition. If a gas when compressed is to be raised to the temperature indicated by theory, it is very essential that all the heat developed in the work of compression enter it. This proposition seems self-evident; nevertheless, it would seem that nearly all the errors that have entered the various discussions and theories regarding this matter have arisen from a neglect of this obvious statement.

We may analyze Joule's experiment in order to gain a clearer understanding of the problem. Suppose the compressing pump had been in a bath by itself, and the cylinder in another bath; also that no heat was lost in the passage of the air from the pump to the cylinder. Under these circumstances a good deal of the heat due to the action of the pump would have passed into its bath, and only a small portion would have been carried by the hot air into the cylinder. Let us consider that a certain definite amount of heating would have taken place if all the heat had entered the air in Joule's original experiment, the formula gives the rise as 123° F. if the initial temperature of the air had been 60°, and the compression was to two atmospheres. In the present instance, however, most of the heat would have been absorbed by the bath around the pump, and would not have been available for heating the compressed air in the cylinder. It is impossible to consider that the same amount of work would have sufficed to heat the water around the pump, and then would have developed heat enough to raise the temperature of the air in the cylinder 123°.

Again, suppose that the compressed air, before entering the cylinder, had its temperature lowered to the outside temperature; is it not plain that all the heat developed in the work of compression would be disposed of, and none at all would be available for heating the compressed air? We see, then, that it is entirely feasible to bring about certain conditions under which a gas may be greatly compressed without being heated.

Let us take two equal cylinders connected by a tube and compress the air in one, A, to three atmospheres, the air in the other, B, being at atmospheric pressure. Let the air in A be at the temperature of the outside air. On opening communication between the cylinders the air in A will be slightly chilled, owing to the work of imparting a certain velocity to those particles rushing into B; while the air in B will be heated slightly from the impact of the particles rushing out of A. All the heat due to the work of compression, however, will have disappeared, and none will be available for heating the air in B (See Enc. Brit, Vol. XXII., p. 480, section 34).

Lastly, suppose that the air in A should be allowed to escape into the open air; the resistance to the rush of the air would be much less than in the last case, and hence a greater velocity would be imparted to the particles rushing from A, and the cooling would be slightly greater than before. The situation appears very plain, and there is no difficulty now in understanding why the earlier experimental heating and cooling was only 4°.

These views seem almost startling in their nature, and if true certainly have profound significance. Let us try to picture the real condition of the gas when under compression and flowing from one reservoir to another. The confined air has a certain potential energy and a capacity for work; it may flow into any reservoir where the air is at atmospheric pressure without losing its potential energy, and hence, if none of its energy is lost, it cannot be used up in heating the air. Is it not like the water in a pond having a certain head or capacity for work? We may enlarge the pond, and allow the water to flow over a larger area; but the capacity for work will be diminished very slightly. X.

Feb. 23.

The Balloon Problem.

The problem of the amount of work done by the gas in a balloon expanding as the balloon rises, as proposed in *Science* for Feb. 19, may be much more significant than even the proposer has thought. Take a bag perfectly flexible and holding two cubic feet. Force out all the air and tie the neck. If we attempt to separate the sides, we shall find it impossible to do so; as the air presses upon it fifteen pounds to the square inch. Allow a cubic foot of dry air to enter and again close the bag. We shall find the same difficulty as before in further opening the bag. Consider that the air in the bag has been heated 490°, which will just fill the bag. To separate the molecules has required a work equivalent to lifting 2,160 pounds one foot, and for convenience we say that the gas in expanding has lifted the weight of the atmosphere. Is it proper, however, to think of the outside air as having been lifted? Has any more outside air been lifted than the 1.2 ounces that a cubic foot weighs? The work, then, has been internal and not external. This is a very important distinction. The external work has been only that required to lift the weight of air displaced.

This can be shown best, perhaps, by determining just how much change has taken place in the behavior of the bag to outside influences. If any external work has been done, we ought to be able to measure it. If the bag with its two cubic feet of air were left to itself, it would soar aloft, and it would require a weight of just 1.2 ounces to restrain it. We say the heated air displaces two cubic feet of air at the outside temperature; and since its density is just half that of the outside air, it can lift a weight equal to that of one cubic foot of air.

Instead of heating the air, let us connect the empty bag with a reservoir having a gas which has a density just half that of the air. Here the conditions are entirely changed. The reservoir, to all intents and purposes, is connected with the outside air, and when we connect the mouth of the bag with it, there is no more work required to expand the bag than if we had opened it into the outside air. In the case before, after closing the bag, we could not open it till some internal work had been done in expanding the air; but now that internal work is not needed, and the only work done by the gas in expanding the bag is that required to lift one cubic foot of air one foot. The lifting power of the bag is precisely the same as it was when it contained air at 490°. The amount of external work in expanding the bag, or capacity to do external work, is exactly the same.

Take the same bag, empty as at first, and connect it with a reservoir containing two cubic feet of air at the outside temperature but at a pressure of two atmospheres. The air will flow quickly into the bag and an equilibrium will be established with the pressure at one atmosphere in both the reservoir and bag. How much external work has been done? Has the air in expanding lifted an enormous weight? Certainly not; the external work has been equal to that required to lift two cubic feet of air, or 2.4 ounces, one foot. Here again we have entirely different conditions from those in the first case. On connecting the bag with the reservoir we virtually opened it to the outside air, and the outside air did all the work which in the first case was needed to be done in separating the particles of air, or in increasing their kinetic energy. We can see this at once by the following considerations. Open the bag into the free air; we can pull the sides apart to their fullest extent. Now connect the opened bag with the reservoir which has the air at the outside pressure, the conditions remain exactly as before, when the mouth of the bag was open to the outside air. Empty the bag and connect it with the reservoir. No change will take place, but the reservoir will virtually be connected with the outside air. Now gently force air into the reservoir; the connection of the bag with the outside air will remain as before, and when the bag is full the only work external to the reservoir will be that of lifting 2.4 ounces one foot.

When a balloon rises into the atmosphere, then, the gas does not expand, and in so doing perform an enormous amount of external work; but it simply displaces the air. The amount of work in this case would be very small indeed, and the consequent cooling of the gas slight. The conditions are precisely similar to what they were when we connected the bag with our reservoir having the air under pressure. In rising, the balloon continually arrives at a region in which the pressure is less and the expanding gas simply displaces the surrounding air. Every cubic foot expansion in the gas of the balloon at sea level displaces a cubic foot of air at a pressure of thirty inches. If the pressure of the outside air were suddenly diminished to ten inches, the work done would be that of lifting a gas weighing one-third of the air at normal pressure, or about .4 ounces to each cubic foot. This would cause almost an inappreciable cooling in the gas.

A very interesting point may be mentioned in this connection. What became of the energy stored in the reservoir in the air compressed to two atmospheres, after the air had expanded to normal pressure in the reservoir and bag? PARADOX.

February 26, 1892.

The Loup Rivers in Nebraska.

I AM gratified that my article of Jan. 29 possessed some interest for so able an authority as Professor W. M. Davis of Harvard, albeit, he is somewhat critical.

My main propositions, and I think they will stand, notwithstanding the objections of my critic, are these: —

1. The Loup rivers were probably once "separate tributaries of the Platte, all independent of each other, as roughly indicated by the dotted lines on the map" (Fig. 1, p. 59, *Science*, Jan. 29, 1892).

2. Pliocene lacustrine deposition along the Platte "crowded the mouths of these tributaries eastward and made them coalesce into a single large tributary."

3. Headwater erosion "swept the upper courses westward by a series of captures."

Instead of my first proposition, Professor Davis ascribes to me the postulate "that at the beginning of the current cycle of river history the several branches of the Loup River all pursued independent courses to the Platte." He makes definite my indefinite "once," but not in a way that I can accept. The plain inference from my second proposition is that the period of separate existence of these tributaries was in the Miocene.

Whether that is equivalent to the "postulate" of Professor Davis depends upon the definition of "cycle." The facts, as I have read them in the field, are these: In Miocene times tributaries of the Platte, now constituting the Loup system, were developed only to the stage of young rivers, not mature rivers, as Professor Davis supposes. Then came submergence and partial obstruction of their valleys; partial only, because the Pliocene marls will not average more than fifty feet in thickness, not one-fourth of the depth of the valleys. When Lake Cheyenne retired, the rivers resumed business in their former channels, except near the Platte, where the excessive deposition turned them eastward. The silt in the Platte valley has been penetrated to the depth of five hundred feet without reaching the bottom.

Here then is a cycle of river history interrupted in its infancy, and subsequently resumed. Its course was not half run when the rivers were drowned, and, even now, after their emergence and resurrection, they are still young rivers, with abundant vigor and abundant opportunities for headwater erosion and river piracy. If this series of events may be accounted a single cycle, notwithstanding the Lake Cheyenne episode, then I can adopt the "postulate" as equivalent to my first proposition.

If I understand him aright, Professor Davis does not raise any objections to my second proposition. He does indeed argue against a supposed contention of mine, which is not mine at all, namely, that the coalescence of the lower courses into one Loup River was due to headwater erosion.

The effects which I did assign to headwater erosion were limited to the "upper courses," as stated in the third proposition. In spite of all objections, that proposition seems to be reasonable and valid. No region on this continent is more favorable for the study of simple, unobstructed headwater erosion than these western plains. The rivers are young. Great blocks of table lands lie yet unbroken by drainage lines, and into these fresh ravines are constantly eating back. The tertiary beds are soft and practically homogeneous, so far as resistance to erosion is concerned, so that no question need be raised about dip, strike, folds, or alternations of hard and soft strata. Upon such a terrane the Miocene rivers established themselves with a south east course consequent upon the slope to the south-east. The Rocky Mountain upheaval, together with excessive deposition along the Platte, changed the slope to the north-east, transverse to the established direction of the rivers. Cross-cutting and captures of westerly headwaters was the natural result of this change of slope.

The eastward tilt which the whole country got at the time the Rocky Mountains were elevated also affected the development of the main Loup. Without that upheaval the northern tributaries would have been dammed back by the silt along the Platte, and formed a series of swamps, instead of coalescing in a free-flowing stream.

That objection of Professor Davis, which is based upon the "systematic location" of Prairie Creek "between two parallel and larger rivers in a district of horizontal beds," is not serious. In the first place, I never dreamed of ascribing it to headwater erosion. It is obviously the result of Pliocene deposition crowding the Loup so far from the Platte that subsidiary drainage was developed on the intervening space. In the second place, this latest product, appearing upon the surface of a great mass of Pliocene silt, cuts no figure in determining the primitive course of channels lying at the bottom of that mass of silt.

Further criticisms from Professor Davis will be most welcome

L. E. HICKS.

The Aboriginal North American Tea.

IN *Science* for Jan. 22, 1892, is an abstract of Bulletin No. 14, United States Department of Agriculture, on "The Aboriginal North American Tea," *Ilex cassine*, which recalls to me that during our civil war, when the Confederate soldiers were encamped in the vicinity of the Rappahannock River, especially during the winter of 1862-3, that not only they, but also the inhabitants of that region, used freely the leaves of the American holly tree, *Ilex opaca*, in the preparation of a decoction as a substitute for China tea. This species of holly is not only abundant in that region, but grows to a large size, trees of eighteen inches in diameter and over being not uncommon in the thickets bordering the low grounds of the Rappahannock.

I do not know how they came to begin the use of this decoction, whether from a local handing down of the Indian custom of using the cassena tea, as Wood styles the *Ilex cassine*, or whether it may not have been suggested by soldiers from Alabama, who were numerous in the Confederate army, and who would be more likely to know of the use the Creeks made of the leaves of the shrub holly.

In this connection the question arises as to whether any use was made during our civil war of the leaves of the New Jersey tea, *Ceanothus Americanus*, which were used during the Revolution as a substitute for Chinese tea. JED. HOTCHKISS.

Staunton, Va., Feb. 24.

AMONG THE PUBLISHERS.

THE laboratory course in psychology, by Dr. E. C. Sanford, which is being published in parts in the *American Journal of Psychology*, is to be issued at a later date in book-form. It is the only practical course ever published.

— Messrs. J. Wiley & Sons, publishers of scientific works, New York City, have just issued the fourth edition of Thurston's "Manual of Steam-boilers," and the fourth edition of his "Friction and Lost Work in Machinery and Millwork." These works, like all others on their list, are kept under constant revision, and thus given continually increasing value. Each new edition shows the perfecting touch of the author's hand. Messrs. Baudry & Cie., the French correspondents of this firm, have completed a translation into French of the "Manual of Steam-engine and Boiler Trials," by the same author, and will at once send it to press. They are also translating the "Manual of the Steam-engine," and expect to have that in type before the close of the year, under special arrangements with author and publishers.

— The number for March begins the seventh year of *The Forum*, and for its seventh year several new enterprises in periodical work are announced: first and foremost, the Silver Question. The March number contains two papers on it — one by Mr. Bland, who makes his best argument for silver, and the other by Mr. Leech, director of the mint. In the following months *The Forum* will publish the most thorough discussion of this subject that has been made, by the foremost writers of both continents. These articles will be a special feature of forthcoming numbers. The Educational Investigation into the work of the public schools in the several large cities of the Union has already been announced, and Dr. J. M. Rice, the special student of the most advanced school-work abroad, is now engaged in this task. His articles will begin in an early number. In the March number are two noteworthy educational articles — one by Mr. Clarence King, on "The Education of the Future," wherein he shows the narrow limitations of all our teaching, and points out the yet undeveloped fields and methods, and the other by Professor John Earle on "The Study of English." Another line of special work laid down by *The Forum* is an investigation and discussion of Municipal Government, which is confessedly the weak place in our whole governmental system. The present number contains an investigation made by Professor Peabody of Harvard into the municipal government of Dresden. The Progress of the most Important Arts and Sciences will make a continuous feature of the coming volumes of *The Forum*, such as Music, Sculpture, Painting, Architecture, the Practical Application of Electricity, the Advance of Preventive Medicine, the Progress of Astronomy. Another group of subjects — old subjects that scientific progress makes of perpetual interest — will be Good Country Roads, and How Well they Pay; Scientific Agriculture and its Possibilities; What the Coming Man will Eat and How He will Cook it; and the like. The especial development of *The Forum* will be in the direction of original investigation by experts and authorities, into all classes of subjects of the greatest concern to readers who wish to keep abreast in their thought and lives with the world's progress; and the aim is never to thresh over old straw.

— A revised edition of Herbert Spencer's "Social Statics," the book which has created such a stir among social reformers, will be issued shortly by D. Appleton & Co., simultaneously with its publication in England. Having been much annoyed by the persistent quotation from this work, in the face of repeated warnings,

CALENDAR OF SOCIETIES.

Philosophical Society, Washington.

Feb. 27. — M. W. Harrington, Notes on the Climate of Death Valley; L. A. Bauer, Wilde's Explication of the Secular Variation Phenomenon of Terrestrial Magnetism; B. Pickman Mann, An Attempted Solution of a Social Problem.

Society of Natural History, Boston.

Mar. 2. — W. G. Farlow, Notes on Collections of Cryptogams from the Higher Mountains of New England; G. Frederick Wright, Invasion of Eastern England by Norwegian Glaciers; Additional Evidence Concerning Human Remains under the Sonora Table Mountain, California.

The Numismatic and Antiquarian Society, Philadelphia.

Mar. 3. — Daniel G. Brinton, Mediæval and Aboriginal Dramas.

Wants.

Any person seeking a position for which he is qualified by his scientific attainments, or any person seeking some one to fill a position of this character, be it that of a teacher of science, chemist, draughtsman, or what not, may have the 'Want' inserted under this head FREE OF COST, *if he satisfies the publisher of the suitable character of his application. Any person seeking information on any scientific question, the address of any scientific man, or who can in any way use this column for a purpose consonant with the nature of the paper, is cordially invited to do so.*

A PROFESSORSHIP in Chemistry is wanted by one who has had five years' experience in that capacity. Would prefer to give instruction by lectures and experiments rather than by text-book methods. Would like a position in a college or university where there is a good student's laboratory. Special points of strength claimed are: (1) Thorough control of a class and good order during lectures and recitations. (2) Accuracy in experimenting with chemicals and skill in the manipulation of chemical apparatus. The permission of several distinguished educators has been given to refer to them if required. Would not care to accept a position paying less than $1,500. Address B. E., care of *Science*, 874 Broadway, New York.

ADDRESS WANTED.—Will some one please send the address of the Secretary of the American Philological Society. Also that of Herbert Spencer. "ADDISON," Room 84, 164 Madison St., Chicago, Ill.

ADDRESSES of Old Book Dealers wanted.—Wishing to obtain a number of old books out of print, I very much desire the addresses or catalogues of rare second-hand book dealers. If there is a directory or list of such dealers I should like to obtain possession of one. W. A. BLAKELY, Chicago, Ill.

WANTED.—(1) A white man versed in wood and iron working, able to work from specifications and plans, suited for an instructor of boys; his business to have charge of shops of school, outline and direct the work for foremen and students; salary to be $1,000 per annum (nine months). (2) A man (black preferred) to teach the colored, iron working and forging, subordinate to the preceding; salary, $720. (3) A man (white) competent to take classes in engineering (assistant's position), but with the ability to perform any of the work required in any of the ordinary engineering courses of our universities; salary from $1,000 to $1,500. A. H. BEALS, Milledgeville, Ga.

Exchanges.

[Free of charge to all, if of satisfactory character. Address N. D. C. Hodges, 874 Broadway, New York.]

For exchange.—A fine thirteen-keyed flute in leather covered case, for a photograph camera suitable for making lantern slides. Flute cost $27, and is nearly new. U. O. COX, Mankato, Minn.

To exchange; Experiment Station bulletins and reports for bulletins and reports not in my file. I will send list of what I have for exchange. P. H. ROLFS, Lake City, Florida.

Finished specimens of all colors of Vermont marble for fine fossils or crystals. Will be given only for valuable specimens because of the cost of polishing. GEO. W. PERRY, State Geologist, Rutland, Vt.

For exchange.—Three copies of "American State Papers Bearing on Sunday Legislation," 1891, $2.50, new and unused, for "The Sabbath," by Harmon Kingsbury, 1840; "The Sabbath," by A. A. Phelps, 1842; "History of the Institution of the Sabbath Day, Its Uses and Abuses," by W. L. Fisher, 1859; "Humorous Phases of the Law," by Irving Browne; or other works amounting to value of books exchanged, on the question of governmental legislation in reference to religion, personal liberty, etc. If preferred, I will sell "American State Papers," and buy other books on the subject. WILLIAM ADDISON BLAKELY, Chicago, Ill.

Wanted, in exchange for the following works, any standard works on Surgery and on Diseases of Children: Wilson's "American Ornithology," 3 vols.; Coues' "Birds of the Northwest" and "Birds of the Colorado Valley," 2 vols.; Minot's "Land and Game Birds of New England;" Samuels' "Our Northern and Eastern Birds;" all the Reports on the Birds of the Pacific R. R. Survey, bound in 2 vols., morocco; and a complete set of the Reports of the Arkansas Geological Survey. Please give editions and dates in corresponding. R. ELLSWORTH CALL, High School, Des Moines, Iowa.

For sale or exchange, LeConte, "Geology;" Quain, "Anatomy," 2 vols; Foster, "Physiology," Eng. edition; Shepard, Appleton, Elliott, and Stern, "Chemistry;" Jordan, "Manual of Vertebrates;" "International Scientists' Directory;" Vol. I. *Journal of Morphology;* Balfour, "Embryology," 2 vols.; Leidy, "Rhizopods;" *Science*, 18 vols., unbound. C. T. McCLINTOCK, Lexington, Ky.

To exchange Wright's "Ice Age in North America" and Le Conte's "Elements of Geology" (Copyright 1882) for "Darwinism," by A. R. Wallace, "Origin of Species," by Darwin, "Descent of Man," by Darwin, "Man's Place in Nature," Huxley, "Mental Evolution in Animals," by Romanes, "Pre-Adamites," by Winchell. No books wanted except latest editions, and books in good condition. C. S. Brown, Jr., Vanderbilt University, Nashville, Tenn.

For Sale or Exchange for books a complete private chemical laboratory outfit. Includes large Becker balance (200g to 1-10mg), platinum dishes and crucibles, agate motors, glass-blowing apparatus, etc. For sale in part or whole. Also complete file of *Silliman's Journal* 1862-1885 (62-71 bound); Smithsonian Reports, 1854-1883; U. S. Coast Survey, 1854-1869. Full particulars to enquirers. F. GARDINER, JR., Pomfret, Conn.

of views which he had abandoned, and by the misquotation of others which he still holds. Mr. Spencer some ten years ago stopped the sale of the book in England and prohibited its translation. But the rapid spread of communistic theories gave new life to these misrepresentations; hence Mr. Spencer decided to delay no longer a statement of his mature opinions on the rights of individuals and the duty of the state. The volume includes also "The Man *versus* the State," a series of essays on political tendencies heretofore published separately. Mr. Spencer has secured an American copyright for his new volume.

— P. Blakiston, Son, & Co., announce "A Manual of Autopsies, designed for the Use of Hospitals for the Insane and Other Public Institutions," by I. W. Blackburn, M.D., pathologist to the Government Hospital for the Insane, Washington, D.C. This subject has for several years engaged the attention of the Association of Medical Superintendents of American Institutions for the Insane, that the abundant material afforded the alienist may be systematically studied in all its clinical as well as pathological aspects. A uniform method being desirable, this manual has been prepared by the direction of the association committee, with the co-operation of Drs. Welch and Hurd of the Johns Hopkins Hospital, that by following the described routine in examination, pathologists, and even non-expert physicians, may prepare the most concise, graphic, and useful record of actual cases. It is fully illustrated from original drawings, sectional and regional, and as an adopted standard, should be in the hands of every examiner who can contribute to the valuable records thus established.

— D. Appleton & Co. have just ready "Moral Teachings of Science," by Arabella B. Buckley, intended for readers who would not take up an elaborate philosophical work; and a "Manual of Chemical Technology," by Randolph von Wagner, translated and edited by William Crookes.

SCIENCE

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SCIENCE

NEW YORK, MARCH 11, 1892.

THE SCIENTIFIC ALLIANCE.

THE Scientific Alliance of New York was organized in March, 1891. It consists at present in a union of six societies engaged in the promotion of scientific research. It is probable that this number will soon be increased to eight, and it is hoped that it may ultimately extend to at least ten. Membership in the Alliance is not confined to societies in New York City, but may include those in the neighborhood.

The societies now composing the Alliance,—naming them in the order of their foundation,—are as follows: 1. The New York Academy of Sciences, 2. The Torrey Botanical Club, 3. The New York Microscopical Society, 4. The Linnean Society of New York, 5. The New York Mineralogical Club, 6. The New York Mathematical Society.

The societies do not in any way sink their individuality or surrender any part of the management of their own affairs. Their union is merely in the way of co operation for the advancement of science and for mutual encouragement, carried out through a central representative body, known as the Council, having advisory powers only. The Council is made up of the president, *ex-officio*, and two other delegates from each society.

A monthly bulletin is issued under the authority of the Council, announcing the proposed proceedings of all the societies, and a copy of this bulletin is sent to every member. The bulletin contains an invitation to the members to attend the meetings of all the societies.

The Council issues an annual directory, containing the names and addresses of all the resident members of the societies, as well as general information as to the character and purposes of the several organizations. It is proposed to issue also a brief annual report of the work done by the societies as a whole. The first directory published by the Council (that for 1891) contained 499 names. That for 1892 will contain a considerably larger number, as the membership of the societies has increased materially during the past year.

The New York Academy of Sciences was chartered as The Lyceum of Natural History, April 20, 1818. It was reorganized under its present name Feb. 21, 1876. It has a total membership of about 550, of which nearly one-half are resident members and fellows. It holds weekly meetings, on Monday evenings, from October to June. One evening of each month is devoted to a popular lecture. There are special sections of mineralogy and astronomy. Its place of meeting is now at Columbia College. The Academy publishes both Annals and Transactions. The Lyceum of Natural History was the owner of a building and a valuable scientific collection, which were destroyed by fire. The Academy possesses a library of between 10,000 and 12,000 volumes, which is being continually augmented by periodicals and Proceedings of kindred societies received in exchange for its own publications. This is an exceedingly important collection of scientific works, containing sets of the Proceedings of foreign bodies not to be found in any other library in New York, and in some cases not elsewhere in this country. At present the books are deposited in the library-building of Columbia College, but they may be withdrawn at any time.

The Torrey Botanical Club was incorporated April 21, 1871. It has a total membership of nearly 300, of which about one-half are resident members. It holds meetings twice a month, at Columbia College, and field-meetings every Saturday from April to November. It publishes a Bulletin and Memoirs. It has an herbarium of nearly 20,000 specimens. Its botanical library is incorporated with that of Columbia College. It consists of periodicals and Proceedings of other scientific societies, obtained by the exchange of publications, which are, for the most part, duplicated in the library of the Academy of Sciences.

The New York Microscopical Society was incorporated in 1877. It has a total membership of about 100, of whom some 75 are active members. Its meetings are held twice a month, at the Mott Memorial Library, No. 64 Madison Avenue. It publishes a quarterly journal. Its library consists of about 2,000 volumes, and is deposited at its place of meeting. It has also a collection of about 5,000 microscopical specimens.

The Linnean Society of New York was organized March 7, 1878. It has a membership of 85, of which about half are resident members. Its meetings are held twice a month, at the American Museum of Natural History. It publishes Transactions and an Abstract of Proceedings. It has a library consisting of exchanges from publications.

The New York Mineralogical Club was organized in 1887. It has a memberihip of about 60. It holds monthly meetings at various places. It owns the Chamberlain collection of New York Island minerals, which is deposited temporarily, with other strictly local minerals, in the American Museum of Natural History.

The New York Mathematical Society was organized Nov. 24, 1888. It has a membership of over 200, including almost every mathematician of note in America, and some residing abroad. Its local membership is about 35. It publishes a monthly Bulletin.

It will be seen from the foregoing summary that all of the societies included in the Alliance occupy only temporary quarters, and that their libraries and collections are widely scattered. It will be observed, however, that the latter are of sufficient size and importance to make a very creditable appearance if they could all be gathered in a single suitable place. It is confidently believed that the total amount of original scientific work brought out by the meetings of these societies is as great as that accomplished in any other city in America. Under proper conditions, however, the societies might not only become more helpful to one another, but might confer a greater benefit upon the community at large, by carrying on lines of work which they are now compelled to neglect from want of room and facilities. For example, all attempts at exciting popular interest in scientific subjects is now confined to a course of seven or eight lectures during the year, carried on by but one of the societies, when, in fact, if the Alliance were placed in possession of the necessary building and appliances, there is no reason why it might not exert the same educational influence in New York as is put forth by the Royal Institution of Great Britain in London, in which a course of as many as eighty lectures of more or less popular interest has been given in a single season.

The brief experience which the Scientific Alliance has already had has convinced the members that a still closer union of the societies is necessary to the most effective accomplishment of their purpose, and this feeling has taken the form of an earnest movement for obtaining a permanent building as a home for all the societies. A building committee was appointed in October last, and has held several meetings and done much towards developing plans for the accomplishment of the object mentioned.

In the main these plans embrace the idea of the erection of a building, in the central part of the city, large enough to afford each society rooms for its ordinary meetings, for its library and collections, as well as facilities for research, and also to contain a lecture-hall, capable of seating twelve hundred people, to be used by all the societies in their public work. It is part of the aim of the Council to obtain, ultimately, if not at once, in connection with the proposed building, a fund for its maintenance and for the endowment of original research and publication.

It is hoped and believed that at this time, when public spirit appears to be undergoing a revival in New York, and numerous worthy objects are receiving generous aid and establishment by men of wealth, the cause of science will not be overlooked or neglected. Music and other fine arts and various charities have recently received munificent assistance in the very direction in which the Alliance is looking for aid,— namely, the erection of buildings suited to their particular needs,— and it seems reasonable to think that the man, or men, will soon be found with sufficient appreciation of scientific research, for both its educational and its practical value, to place it in a position as solid and substantial as that now likely to be occupied by the fine arts and by organized benevolence.

ACTINISM.

On studying the nature of the action of the blue, or rather the violet, ray of the spectrum, it appears to me to be a misnomer to refer to it as chemical. The absorption of heat attends chemical decomposition, and on the other hand the disengagement of heat is the accompaniment of chemical combination. We read in Professor Wurtz's excellent treatise on "The Atomic Theory:" "It is heat which sets the atoms in motion; they have absorbed heat in separating from each other, since the rupture of the molecular equilibrium which marks the end of the state of combination has required the consumption of a certain quantity of heat. The heat thus absorbed has restored to the atoms the energy which they possessed before combination, and which represents affinity. This heat is lost again whenever the atoms, passing into the sphere of action of other atoms, fix the latter in some manner or are fixed by them so as to form new systems of equilibrium — that is, new molecules — in which henceforth their vibration and motion are preserved. This action is reciprocal." If with this we compare what takes place in the so-called chemical action of the violet ray, we find a great difference. The latter process is usually referred to as one of decomposition and not of combination, and, in fact, photography is based on the property possessed by light of decomposing chemical compounds by its reducing action.

It is true that this decomposition is supposed to be attended with certain chemical changes, as is the case also with the decomposition of amyl and other vapors in Dr. Tyndall's very interesting experiments in cloud making, although there appears to be some doubt as to the nature of the changes. Moreover, in the action of the violet ray on a mixture of chlorine and hydrogen gases the formation of hydrochloric acid would seem to be due to the operation of chemical affinity. Nevertheless, when we consider the analogy between this case and that of the formation of water by the passage of a current of electricity through a mixture of oxygen and hydrogen gases, a question may be raised as to whether the former is due to strictly chemical action. The phenomenon of electrolysis, in which the electric current decomposes a molecular compound, is, moreover, analogous to that of the decomposition of chemical compounds by the actinic action of the violet ray. The latter phenomenon answers to the decomposing action of heat, and the former to the combination of elements which attends chemical action; but they are not the same. This is evident from the fact that, while in the one case the combination precedes the discharge of heat on which decomposition depends, in the other case it follows decomposition.

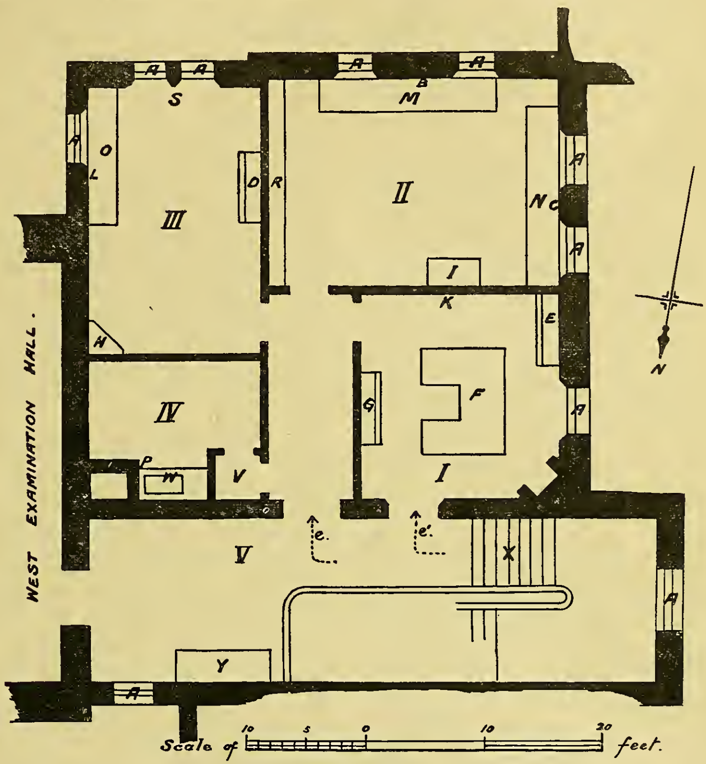
Nevertheless, in all cases actinic action would seem to be attended with the aggregation of at least one element of the decomposed chemical compound. Thus, when on the exposure of chloride of silver to the action of light the chlorine is expelled, the silver is precipitated. The result depends on the instability of the equilibrium of chemical combination in the presence of certain light-rays, and it is thought that all substances are thus more or less affected by light. It is found that the red rays are chemically inactive, and of the others the absorbed rays are those which bring about the decomposition which is the basis of actinic action. The liquid nitrite of amyl allows the transmission of the yellow rays, and Dr. Tyndall states that the blue rays, as complementary to the yellow, are absorbed, and therefore that they produce the "chemical" effect. As a fact, however, the complementary of yellow is violet, and the greatest actinic action is in the violet ray, and it extends far beyond into the invisible rays. This in itself would seem to prove that actinism is not chemical action, as the intimate relation between this force and heat would lead us to expect the association of chemical action with rays towards the red end of the spectrum. The vibrations of heat are atomic and not molecular, and possibly this fact may have influenced Dr. Tyndall in his opinion that the absorption of the actinic rays occurs in the main within the molecule, and are not the act of the molecule as a whole. There is no reason, however, why the absorption should not be of the whole molecular mass; that is, of the body of molecules that make up the mass, just as the absorption of heat is that of the atoms which make up the molecule.

Here would seem to be the real explanation of the phenomena of actinism, which is a distinct power of light due to its activity as a molar energy, just as heat is an atomic energy. The combination which follows the decomposition effected by actinic action has a similar relation to chemical combination. The latter is atomic, whereas the former is molar, as it affects the mass, and this through its molecules and not through the atoms of which these are composed. From the fact that the electric light contains a large proportion of actinic rays, and that the electric spark in rarified air is diffused and of a violet color, it might be supposed that actinism is only a phase of electricity. That they are closely related we may judge by what was said above, but there are reasons for believing them to differ from each other as they both differ from heat, although all alike are forms of energy. Actinic absorption, like coloric absorption, is attended with decomposition, but so far as the former is attended with or followed by an aggregation or combination of elements, as with chemical affinity, it is also a force, but molar rather than molecular or atomic. In distinguishing between these forms of matter, I adopt the principle laid down by Mr. Grant Allen, although not all the applications he makes of them, and I believe that in the recognition of the truth of those principles will be found the solution of many scientific problems.

C. STANILAND WAKE.

THE PSYCHOLOGICAL LABORATORY IN THE UNIVERSITY OF TORONTO.[1]

IN the spring of 1891 an appropriation of $1,100 was made for the equipment of a laboratory for experimental psychology at the instance of the writer. A suite of rooms, of which the accompanying cut gives the dimensions and arrangement, was set apart for the use of this department. The laboratory is located at the west end of the restored University College building on the first (not the ground) floor. It is isolated entirely from the general work of the building, being over the rooms of the physical department. The rooms have light exposure from three sides. The room which is used for students' demonstration and practical work (I. in the plan) is cut off from the research rooms, thus making



A, A, A, Windows.

I. Demonstrating-room and work-room for undergraduates. G. Work-table; E. Book-cases; K. Blackboard; F. Demonstration-table; e'. Students' entrance; e. Professor's entrance.
II. Research-room. M, N. Work-tables; B, C. Lockers, movable incandescent lights; I. Chart-case, movable tables; R. Instrument-cases.
III. Professor's Research-room. O. Work-table; D. Book-cases; H. Closet for tools, &c; L. Movable incandescent light, lockers; S. Writing-desk.
IV. Dark-room. W. Sink; V. Vestibule; P. Incandescent light.
V. Private hall. X. Stairs; e. Professor's entrance; Y. Instrument-cases.

interruptions to the latter from noise, etc., unlikely. For the same reason, the central hall is laid with cocoa matting. The work-tables of the research rooms (II. and III.) get light from the east, south, and west, a variety which is of great value, especially as the east exposure (Room III.) has reflected light from the walls of the main building (this is also partly the case with the light from the west windows, Rooms I. and II.). The rooms are artificially lighted by combination gas and electric chandeliers from the ceilings, and have besides movable incandescent lamps over the work-tables. The dark room is also furnished with incandescent lights. The floors throughout are carefully laid in hard wood. The

[1] The accompanying plan is published at the suggestion of several psychologists who have borrowed and examined it; it is thought that the details may be of use to professors, boards, or trustees who are contemplating the providing of laboratories.

work-tables are braced diagonally from the walls by iron rods. The rooms are heated by steam radiators. The walls and ceilings are finished in dull white and the woodwork in dark walnut, colors being avoided in order to keep the physiological conditions of sight normal. Natural and colored light can be let into the dark room through the south wall. The central hall is lighted through glass panels in the doors.

The fittings of the laboratory have cost about $450 — a grant additional to the appropriation of $1,100 for instruments. This does not include, however, the arrangements for lighting, heating, and the special flooring. It is probable that the cost would be slightly more in the United States. Of the original amount appropriated, moreover, $300 is an annual allowance for the maintenance of the laboratory. The writer hopes, also, to have soon a paid assistant, who will be constantly at work in the rooms.

The laboratory will, it is hoped, serve two main purposes: First, it is used to illustrate the undergraduate courses in psychology in the university; and, second, it is designed to serve as a centre for advanced research in the new lines of experimental work. Being the only foundation of the kind in Canada,[1] it will represent what we are doing in this line in the Dominion. The Department of Education of Ontario undertakes with great liberality to publish the researches of students who do work of real merit, and to distribute them generously. Publications issued from other such centres everywhere will be received in return with much gratitude; and new ideas in matters of technique, arrangement, etc., especially detailed notices of new pieces of apparatus, reprints from the journals, and announcements of new discoveries, will be welcome. J. MARK BALDWIN.

[1] The first in the British Dominion as far as my information goes.

NOTES AND NEWS.

AT a meeting of the Royal Geographical Society on Feb. 22, Mr. Theodore Bent read before a large audience a paper on his recent exploration among the Zimbabwe and other ruins. The paper, says *Nature*, was one of great interest. Mr. Bent said that, with his wife and Mr. Robert Swan, he went to Mashonaland primarily to examine the ruins of the Great Zimbabwe. These ruins, so named to distinguish them from the numerous minor Zimbabwes scattered over the country, were situated in south latitude 20° 16′ 30″, and east longitude 31° 10′ 10″, at an elevation of 3,300 feet above the sea-level, and formed the capital of a long series of such ruins stretching up the whole length of the west side of the Sabæ River. They covered a vast area of ground, and consisted of the large circular building on a gentle rise with a network of inferior buildings extending into the valley below, and the labyrinthine fortress on the hill, about 400 feet above, naturally protected by huge granite bowlders and a precipice running round a considerable portion of it. Mr. Bent gave a minute description of the ruins, drawing attention to evidence that their ancient inhabitants must have been given to the grosser forms of native worship. Perhaps the most interesting of their finds in one portion were those in connection with the manufacture of gold. Mr. Bent held that the ruins and the things in them were not in any way connected with any known African race; the objects of art and the special cult were foreign to the country altogether, where the only recognized form of religion was, and had been since the days when the early Portuguese explorers penetrated into it and El Masoudi wrote, that of ancestor worship. It was also obvious that the ruins formed a garrison for the protection of a gold-producing race in remote antiquity. So we must look around for such a race outside the limits of Africa, and it was in Arabia that we found the object of our search. All ancient authorities speak of Arabian gold in terms of extravagant praise. Little, if any, gold came from Arabia itself; and here in Africa gold was produced in large quantities, both from alluvial and from quartz, from the remotest ages. A cult practised in Arabia in early times was also practised here; hence there was little room for doubt that the builders and workers of the Great Zimbabwe came from the Arabian peninsula. He had no hesitation in assigning this enterprise to Arabian origin, and to a pre-Mahommedan period.

— The United States Hydrographic Office makes a report of the magnetic storm of Feb. 13–14, 1892, as recorded by the self-registering magnetic instruments of the United States Naval Observatory, Washington, D.C. These records of this unusually severe magnetic storm are of especial interest as occurring at the same time as the fine displays of auroræ and the appearance of a large group of sun spots. The magnetic storm commenced suddenly at 12.40 A.M. (75th meridian time), Feb. 13, with a movement of the north end of the declination magnet to the westward and a rapid increase in the horizontal and decrease in the vertical components of the earth's magnetic force. The north end of the declination magnet remained to the westward of its normal position until 10.30 A.M, when it crossed to the eastward, all the time oscillating violently, and did not return to its normal position until 8 P.M. of the 13th, after which it kept oscillating on each side of its mean position until the end of the storm. It registered a change of direction of $1\frac{1}{2}°$. The first increase in the horizontal force was followed by a rapid decrease, the force falling to much less than its usual strength, with rapid changes. Its change during the storm was $2\frac{1}{2}$ per cent of its mean strength. The vertical force decreased so much that the sensitive balanced magnet used to record it was upset at 8 P.M. of the 13th, and its further record lost. The auroræ were seen at Washington at about 2 A.M. and 7.30 P.M. of the 13th, the latter time being marked by an unusually disturbed condition of the magnets.

— The usual monthly meeting of the Royal Meteorological Society was held on Wednesday evening, the 17th of February. A paper on "The Untenability of an Atmospheric Hypothesis of Epidemics" was read by the Hon. Rollo Russell. The author is of opinion that no kind of epidemic or plague is conveyed by the general atmosphere, but that all epidemics are caused by human conditions and communications capable of control. In this paper he investigates the manner of the propagation of influenza, and gives the dates of the outbreaks in 1890 at a large number of islands and other places in various parts of the world. Mr. Russell says that there is no definite or known atmospheric quality or movement on which the hypothesis of atmospheric conveyance can rest, and when closely approached it is found to be no more available than a phantom. Neither lower nor upper currents have ever taken a year to cross Europe from east to west, or adjusted their progress to the varying rate of human intercourse. Like other maladies of high infective capacity, influenza has spread most easily, other things being equal, in cold, calm weather, when ventilation in houses and railway cars is at a minimum, and when perhaps the breathing organs are most open to attack. But large and rapid communications seem to be of much more importance than mere climatic conditions. Across frozen and snow-covered countries and tropical regions it is conveyed at a speed corresponding, not with the movements of the atmosphere, but with the movements of population and merchandise. Its indifference to soil and air, apart from human habits depending on these, seems to eliminate all considerations of outside natural surroundings, and to leave only personal infectiveness, with all which this implies of subtle transmission, to account for its propagation. "The Origin of Influenza Epidemics" was the title of a paper by Mr. H. Harries. The author has made an investigation into the facts connected with the great eruption of Krakatoa in 1883, and the atmospheric phenomena which were the direct outcome of that catastrophe. He has come to the conclusion that the dust derived from the interior of the earth may be considered the principal factor concerned in the propagation of the recent influenza epidemics, and that, as this volcanic dust invaded the lower levels of the atmosphere, so a peculiar form of sickness assailed man and beast. A "Report on the Phenological Observations for 1891" was made by Mr. E. Hawley. This report differs in many respects from the previous reports on the same subject. Among other changes, the number of plants, etc., selected for observation has been greatly reduced, while the number of observers has considerably increased. The winter of 1890–91 proved in England very destructive to the root crops, as well as to green vegetables and tender shrubs. Birds also suffered severely. In Scotland and Ireland, however, there was scarcely any severe weather until March. The flowering of wild plants was greatly retarded by cold in the spring, but during the summer the departures from the average were not so great. The harvest was late and its ingathering much interfered with by stormy weather.

— Recent experiments by Messrs. W. Thomson and F. Lewis on the action of metals on india-rubber, according to *Engineering*, show that that of copper is the most deleterious. Platinum, palladium, aluminium, and lead act only very slightly, while magnesium, zinc, cadmium, cobalt, nickel, iron, chromium, tin, arsenic, antimony, bismuth, silver and gold have no action whatever on this material. Of metallic salts, those of copper are very destructive, but nitrate of silver, manganese oxide, and several less common salts are equally so. The nitrates of iron, sodium, uranium, and ammonia have also a deleterious action, though less pronounced than in the case of the salts previously mentioned.

— At the anniversary of the British Geological Society, held on the 19th of February, the retiring president, Sir Archibald Geikie, gave the annual address, which was devoted to a continuation of the subject treated of by him last year. He now dealt, according to *Nature*, with the history of volcanic action in this country from the close of the Silurian period up to older Tertiary time. The remarkable volcanic outbursts that took place in the great lakes of the Lower Old Red Sandstone were first described. From different vents over central Scotland, piles of lava and tuff, much thicker than the height of Vesuvius, were accumulated, and their remains now form the most conspicuous hill-ranges of that district. It was shown how the subterranean activity gradually lessened and died out, with only a slight revival in the far north during the time of the Upper Old Red Sandstone, and how it broke out again with great vigor at the beginning of the Carboniferous period. Sir Archibald pointed out that the Carboniferous volcanoes belonged to two distinct types and two separate epochs of eruption. The earlier series produced extensive submarine lava-sheets, the remains of which now rise as broad terraced plateaux over parts of the lowlands of Scotland. The later series manifested itself chiefly in the formation of numerous cones of ashes, like the *puys* of Auvergne, which were dotted over the lagoons and shallow seas in central Scotland, Derbyshire, Devonshire, and the south-west of Ireland. After a long quiescence, volcanic action once more reappeared in the Permian period; and numerous small vents were opened in Fife and Ayrshire, and far to the south in Devonshire. With these eruptions the long record of Palæozoic volcanic activity closed. No trace has yet been discovered of any volcanic rocks intercalated among the Secondary formations of this country, so that the whole of the vast interval of the Mesozoic period was a prolonged time of quiescence at last when the soft clays and sands of the Lower Tertiary deposits of the south-east of England began to be laid down, a stupendous series of fissures was opened across the greater part of Scotland, the north of England, and the north of Ireland Into these fissures lava rose, forming a notable system of parallel dykes. Along the great hollow from Antrim northwards between the outer Hebrides and the mainland of Scotland, the lava flowed out at the surface and formed the well-known basaltic plateaux of that region. The address concluded with a summary of the more important facts in British volcanic history bearing on the investigation of the nature of volcanic action. Among these Sir Archibald laid special stress on the evidence for volcanic periods, during each of which there was a gradual change of the internal magma from a basic to an acid condition, and he pointed out how this cycle had been repeated again and again even within the same limited area of eruption. In conclusion, he dwelt on the segregation of minerals in large eruptive masses, and indicated the importance of this fact in the investigation, not only of the constitution and changes of the volcanic magma, but also of the ancient gneisses where what appear to be original structures have not yet been effaced.

— Dr. L. Swift of Rochester, N.Y., discovered a bright comet on the morning of March 6. The object is in R.A. 18 h. 59 m., Dec. south 31° 20′. It is moving easterly.

— As bearing on the vital question of the exhaustion of the coal resources of Belgium *Engineering* states that, while the average depth of the French coal mines is 1,056 feet, the average depth in Hainaut is 1,773 feet; that in the Mons Basin there is a pit now being worked of 2,988 feet in depth, and another unworked pit in the same district of 3,801 feet; while in April last it was reported that in a Borinage pit, known as "Sainte Henriette des produits," at Flénu, a rich seam of coal had been discovered at the extraordinary depth of 4,120 feet. These figures tend to show that Belgium is rapidly exhausting the "cream of the coal resources" of the country — that is, coal found within 2,000 feet of the surface.

— A. Coppen Jones, writing from Davos Platz, Switzerland, to *Nature*, says: "In 1889 a French naval surgeon, M. Ledantec, published in the *Annales de l'Institut Pasteur* the result of some investigations he had made into the nature of the arrow poison of the natives of the New Hebrides. Wounds from these arrows give rise, as is well known, to tetanus, and M. Ledantec was able, by the subcutaneous injection of the scraped off poison, to kill guinea-pigs under typical tetanic symptoms. He learnt from a Kanaka that they are prepared by smearing the arrow-heads (which are made of human bone) first with tree gum and then with mud from a swamp, which mud he found to contain numbers of Nicolaier's tetanus bacillus. As far as I am aware, this has been recorded only of the natives of the New Hebrides and some of the neighboring groups (the arrow poison of Stanley's dwarfs is certainly *not* the same), and I was therefore much interested some days ago by coming accidentally upon an old record which seems to show that the natives of the Cape Verd coast were accustomed, more than three hundred years ago, to get rid of their enemies in a similar manner. In Hakluyt's "Voyager's Tales," published in 1589 (I refer to the little reprint edited in 1889 by Henry Morley), is the narrative of one Miles Phillips, in which occurs the following passage: 'Upon the 18th day of the same month (November, 1567) we came to an anchor upon the coast of Africa at Cape Verde, in twelve fathoms of water, and here our General landed certain of our men, to the number of 160 or thereabouts, seeking to take some negroes. And they, going up into the country for the space of six miles, were encountered with a great number of negroes, who with their envenomed arrows did hurt a great number of our men, so that they were enforced to retire to the ships, in which contest they recovered but a few negroes; and of these our men which were hurt with their envenomed arrows, there died to the number of seven or eight in a very strange manner, with their mouths shut, so that we were forced to put sticks and other things into their mouths to keep them open.' In the language of modern medicine, they succumbed to tetanus traumaticus. The voyagers left the coast soon after, and there is no further mention of the natives or of the wounded. There is, of course, no proof that the arrows were poisoned with mud or earth, but the probability is considerable. The chief interest lies in the age of the record, which forms in some manner a pendant to the researches of M. Bossano (*Comptes rendus*, 1888), which showed the tetanus bacillus to have a very wide distribution in space. It is a curious consideration that this and the other famous arrow poison, curare, both kill by their action on the voluntary muscles, the action of one being diametrically opposed to that of the other."

— The *Electrical Review*, New York, the first electrical weekly published in this country, issued a decennial number dated Feb. 20, 1892, in commemoration of its tenth birthday. The past decade of electrical progress is presented, and what may be expected in the future of this science is outlined. Articles specially contributed to this issue by leading electrical workers appear, with many portraits of interest.

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CURRENT NOTES ON ANTHROPOLOGY. — I.

[*Edited by D. G. Brinton, M.D., LL.D.*]

Evolution of the Human Skull.

DR. PAUL TOPINARD of Paris, whose studies in physical anthropology place him in the front ranks of that science, has summed up in a recent number of *L'Anthropologie* the results of several years' investigations concerning the transformation of the animal into the human skull. He demonstrates that this change is brought about by the gradual development of the brain, and the resulting mechanical pressure on the hard parts adjacent. The pressure exerted by the enlarging hemispheres on the occipital bone is in a direction backwards and downwards, so that what is its superior surface in ordinary mammals becomes the posterior in man, and its posterior face the inferior. The occipital foramen, instead of looking backwards, is in man turned downwards. The increase in size of the anterior lobes of the hemispheres brings about still greater changes in that portion of the cranium. The orbits are pressed from a lateral into a frontal position, the face, instead of being in front and oblique, becomes vertical, and below the frontal lobes; and numerous minor alterations in the anatomy of the parts are necessitated by these changes. It is easy to arrange a perfectly graduated series of skulls illustrating this development from the lowest mammals up to man. Next to him are the monkeys, below these the lemures, and then follow the inferior mammals. Everywhere the principle of harmonic accommodation of organ to function is strikingly shown. Although the general statement of this evolution has been frequently advanced, it has never before received so complete a demonstration.

Physical Types in the Natives of South America.

The effort has repeatedly been made to subdivide the native tribes of South America on purely physical characters. It was attempted more than fifty years ago by Alcide D'Orbigny, in his "L'Homme Americain;" but his plan has not proved satisfactory. The latest scheme is that of Dr. Deniker, who accompanied the French scientific expedition to Cape Horn. He measured some eighty odd Yahgans, a tribe who live on the southern shore of Tierra del Fuego. He found them of short stature, head large and mesochephalic, prominent superciliary ridges and malar bones, forehead narrow, low, and retreating, eyes small and horizontal, orbits medium, mouth large, lips thick, slight prognathism. On the strength of these measurements, Dr. Deniker has urged in various scientific publications that we find in the Yahgans a "race" quite different from the Patagonians and allied to the Botocudos, the Coroados, and the Aymaras, as well as to the ancient Lagoa Santa peoples. This grouping, allowing that it is anatomically accurate, serves to illustrate how useless is an ethnographic classification based on small anatomical points. The Aymaras, Botocudos and Yahgans are as far apart in language, culture and character as any tribes which could be selected in South America. Moreover, the Botucudos differ widely among themselves is physical aspects, as Dr. Paul Ehrenreich has abundantly shown. In fine, it is high time to dismiss the anatomical subdivisions of the American race, and rely on language as, after all, when prudently employed, our best guide.

Deniker's theories will probably attract the more attention by being brought into relation with the interesting recent discoveries by Florentino Ameghino in the eocene beds of Patagonia. This eminent geologist has described, in a late number of the *Revista Argentina de Historia Natural*, the remains of four species of monkeys from what he believes to be the lower eocene — which would place them far more remote than any found in Eurasia, the oldest there exhumed being from the middle miocene. Ameghino therefore claims Patagonia as the cradle af the first Primates and of the immediate precursors of Man. Nor does he hesitate in this connection to add that in his opinion the very oldest relics of man's activity have been found in the same district.

We must, however, temper this enthusiasm by some hesitancies. When Ameghino assigns these beds to the lower eocene, he does so entirely on palæontologic grounds. The more cautious geologists are getting to rely less and less on these, and to demand more and more stratigraphic testimony. This is alone convincing. The native fauna of Australia to-day is much older in type than that of Eurasia; and similar instances no doubt existed in all ages of the world's history. Moreover, the remains which Ameghino describes are strictly American in type. His *Anthropops perfectus*, although it had its teeth disposed in a semicircle, as in man, had nevertheless thirty-six teeth, as had all the American monkeys, both recent and fossil. His *Homunculus Patagonicus* was yet more Lemurian in type. The evidence is far from adequate, therefore, to substantiate the daring inductions which Ameghino draws from these finds.

The Question of the Celts.

The latest contribution to the vexed question of the ethnographic position of the Celts is from the pen of the veteran anthropologist of Bonn, Professor Schaaffhausen. It is published in the *Festschrift zum Fünfzigjährigen Jubiläum des Vereins von Alterthumsfreunden im Rheinlande.* It includes a careful review of the classical authorities on the Celts and Gauls; in which one is surprised to find a denial that the bands who overran Italy in 393 B.C. were Celtic. Surely the title of their chiefs, *brennus*, "king," is evidence enough that they spoke a Celtic dialect. The professor is also sadly out in attributing the North African blonds to immigration from Europe. The blond type is essentially that of the Hamitic Berbers who have lived in the vales of the Atlas from the remotest times. In attributing the megalithic monuments of western Europe and northern Africa exclusively to Celtic and Germanic peoples, he proceeds beyond what archæologists have conceded. The difficult problem of the conflicting physical types among the Celtic nations — the one short in stature, brachycephalic, and brown, the other tall, dolichocephalic, and blond — he summarily solves by supposing either an intermixture with other types or a change in mode of life and climatic environment. The Celtic language he places, as do now all leading linguists, within the Aryan group and in that category most closely allied to the Italic stock.

The same topic is discussed very ably by the French anthropologist, Dr. R. Collignon, in one of the recent bulletins of the Société d'Anthropologie. After setting forth in strong lights the embarrassing nature of the evidence, he finally leans to Broca's opinion, that the small, brown, brachycephalic Celts are a mixed type; while the true and primitive type, which we may call the Kymric, was one of tall stature, with reddish or blond hair and dolichocephalic crania. An interesting portion of Dr. Collignon's memoir is where he points out the persistency of various physical types in portions of France for many centuries, even for thousands of years, as an examination of ancient sepulchres has proved.

MOTION AND HEAT.

[Continued from p. 135.]

BUT nature has other means of compensation for the molar motion converted into heat. Incalculable units of heat-energy are stored up in vegetable and animal organisms; and in evaporation still more countless units of heat-energy are converted first into molecular, and then into molar motion, in its most terrific forms.

Evaporation and the function it performs in the economy of nature are as yet little understood. It appears to be a form of expansion, and, like expansion, it increases with elevation of temperature; but it does not stop when expansion ceases, for it is well known that ice continues to evaporate below zero C.

It is undoubtedly the great instrumentality for converting heat into motion. It is constantly acting, and in the trade wind region eleven feet of the ocean's depth is annually lifted up and carried off by this silent process. Molecule by molecule the aqueous vapor is torn from the liquid mass, each one carrying or embodying so much heat and thus reducing temperature; in other words, each molecule moved in evaporation furnishes work in the form of motion for so much of the force or energy which was dynamic in the form of heat.

Molecular motion, evidenced by gaseous expansion in a closed vessel, is governed by the general laws of motion;[1] and it seems incredible and anomalous to hold that the inert molecule moved in evaporation, which unites with its fellows as aqueous vapor, and comes down again as rain, is not governed by the same laws of the motion which this force or energy, in the form of heat, imparts to it in the atmosphere.

If these laws of motion do apply to the motion imparted by converted heat to evaporated molecules, we have an origin for the trade winds far more simple than the generally supposed convection. The trade winds blow over the tropical water where convection is smallest, and not over tropical land, where it is greatest.

But it is sufficient for the present purpose to show that heat is converted into motion in the process of evaporation; and that even if the force or energy which, in the form of molar motion, is directly converted into heat by resistance, cannot be directly reconverted from heat into molar motion, there is in terrestrial nature a law of compensation which tends to convert any surplus of dynamic heat into dynamic motion, and thus preserve the equilibrium which has been observed.

Professor Tyndall has taught us how to trace radiant energy from one body to another, and how the dark or heat rays may be concentrated into the more intense light rays, after they have left the body which sent them forth. And Faraday, Joule, Mayer, Grove, and others have taught us the law of conservation, by which we know that this energy, when it disappears, is not annihilated, and when it reappears it is not a new creation. We see its manifestation in motion, molar and molecular; we feel it in heat, we see it in light and color, and hear it in sound. The motion may cease; light may be extinguished in darkness; colors may fade, and sound give place to profound silence; but the energy or force which caused all these phenomena was the same before they appeared as during their continuance, and its potential existence remains after their disappearance with the same measurable units as when it was dynamic, and subject to observation.

When the demon was cast out of the man and went into the swine, and they ran into the sea, it was the swine, and not the demon, who were drowned. He doubtless passed out into demon land, ready to again become dynamic when occasion offers.

This force, or energy, we are trying to trace, while dynamic, can only do so much work at one time. If it is entirely occupied in moving a mass, it cannot do other mechanical work; and if entirely occupied in molecular motion it cannot elevate temperature, nor become radiant as heat or light. And when rendered entirely potential, as when a ball thrown up is lodged on the roof of a house, or when heat becomes latent in liquefaction or evaporation, or when the sun's energy is locked up in the molecular structure of vegetable and animal organisms, it can do no work at all until again rendered dynamic. Its power and capacity when released is identically the same, neither more nor less, than when it was locked up. This is true whether it was locked up as motion or locked up as heat.

It has always seemed to me to be unfortunate and misleading that Professor Tyndall should have adopted "Heat a Mode of Motion" as the title of the book in which he gives to the world an account of his great and valuable researches in the delimitation of this force. Like the term "Mechanical Equivalent of Heat," it results from mistaking the thing done for the thing doing it, the effect for the cause. Heat is not a mode of motion, and it would be just as inaccurate to call gravity a mode of weight, or magnetism a mode of pull, and even less inaccurate to call motion a mode of heat. Motion and heat are forms or manifestations of the same force or energy, and when radiant, as heat and light, it is more nearly disconnected from ponderable matter than when it assumes the form of molar or molecular motion.

Motion, in all its forms, is the transference of material substance, ponderable or imponderable matter, from one place or part of space to another; it is the state of ponderable matter in which the forces acting on it are not in equi-

[1] "Molecular Motion in the Radiometer," etc., p. 16.

librium. *Rest* is the opposite of motion; it is the state of matter in which the physical forces acting on it are in equilibrium; that is when the force impelling motion in a given direction is counteracted by an equivalent force impelling motion in the opposite direction; or is resisted by a superior force. A stone *rests* on the surface of the earth because the force of gravity acting on the stone is resisted by the force of cohesion in solid matter; but the force continues although there is no motion resulting from it. The stone *sinks* in water, that is, it moves from the force of gravitation because the force of cohesion in the molecules of water is insufficient to counteract the force impelling motion; but when the force of cohesion in the molecules is sufficiently increased by congellation, the stone *rests* on the surface of the ice. So a top spun rapidly *rests* on its peg, because the force giving it horizontal motion counteracts the pull of gravity which causes it to fall when the rotation ceases.

Dr. Mayer defines force as "Something which is expended in producing motion; and this something which is expended is to be looked upon as a cause equivalent to the effect, namely to the motion produced."[1]

This is obviously too narrow to include even dynamic energy. Two horses pulling a vehicle in opposite directions with the same force would produce no motion; divide the force by unhitching one of the horses, and the vehicle moves. Then, according to this definition, we have the absurdity that the whole force is nothing, but half of it is something.

A correct definition of phpsical force is that it is something producing the state of ponderable matter in which it is subject to human observation. Whether the state be one of motion or rest, hot or cold, solid, liquid, gaseous, colored, etc., it is the result of force. We only know physical force from its effects on ponderable matter, and we only know ponderable matter as affected by force.

The supposed difficulty in the concept of an element in nature entirely distinct from, but inseparably connected with, ponderable matter, is entirely factitious. Time and space are such elements, entirely distinct from, and inseparably related to, ponderable matter; and the concept of force as above defined is as absolute and imperative as the concept of time, the concept of space, or the concept of matter itself. The progress of science in tracing a force through its various manifestations, as has been done to some extent with gravity, confirms the primal concept of force which comes with the very dawn of intelligence.

The still more abstract concept of law by which any force is what it is, is also primal, absolute, and inevitable in every human intelligence.

Whether all ponderable matter is one as claimed by some philosophers, or whether all force is one as claimed by other philosophers, are speculations which, with our present knowledge of these elements, are idle if not mischievous.

It is undoubtedly from phenomena resulting from the apparent differences in ponderable matter, and the apparent differences in the forces acting on it, that real progress in unravelling nature has been made.

We need a specific name for this force of which molar motion, molecular motion, heat, and light, are manifestations. There seems to be no doubt that positive electricity is also one of its forms. Electricity, like heat, is developed by friction and by chemical reaction; and its mechanical equivalent, or, more accurately, the electric equivalent of molar motion, doubtless is the same as the heat equivalent of molar motion, or differs from it by some law which will prove the identity of the force. Dr. Mayer suggested that whether friction, which of course is resisted molar motion, developed heat or electricity, depended on the character of the substances used in the friction, homogeneous substances developing heat and heterogeneous substances electricity. There appears to be no essential difference in the chemical reactions which develop heat and those which develop electricity; the difference apparently being in the mode of applying the force or energy and the substances to which it is applied.

Electricity passes from dynamic to potential under not precisely the same conditions as heat, but not more essentially different than the conditions under which motion passes from dynamic to potential, and its dynamic power is exhausted in doing work. This feature of electrical energy has been utilized by Mr. Hodges in his new lightning-rod, constructed of copper ribbon, so arranged that the copper will be dissipated by the electric current.

But I must leave this branch of the subject to those better informed as to the phenomena.

There may be still other forces, or rather forms of force, which may be found to have equivalence and mutual convertibility with heat. It is equivalence and mutual convertibility which warrants the assumption that motion and heat are phenomena resulting from, or, more accurately, are manifestations of, the same force.

In speaking of the force itself, I have used the expression "force or energy" because these words have several meanings, and the sense in which they are synonymous comes nearer the expression of the concept sought to be presented than any other phrase that has occurred to me. But it would facilitate induction if we could call it "Ergic Force," or "Ergism," or give it some other specific designation to distinguish it from other forces, or force generally, including under the term "Ergism" every manifestation of force for which a heat equivalent may be found. This name seems appropriate because it suggests the element in nature which is the basis of work It enables us to grasp a concept of the force distinct from its manifestation in any one of its forms; and if the delimitation itself is correct we can class as "Antergic" the forces, like cohesion, which have no heat equivalent, but which, under certain conditions, render dynamic "Ergism" potential. DANIEL S. TROY.

[1] "Correlation and Conservation of Forces," D. Appleton & Co., 1890, p, 335.

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.*

On request in advance, one hundred copies of the number containing his communication will be furnished free to any correspondent.

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

Further Notes on the Loup and Platte Rivers.

SEVERAL years since it was my privilege to spend several weeks studying the peculiar drainage of central Nebraska I have therefore been much interested in the papers of Professors Hicks and Davis in recent numbers of *Science*. I trust I shall not be intruding if I call attention, at this time, to a few additional facts which seem to have a bearing on the discussion.

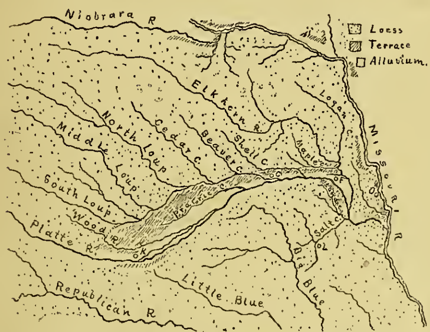
1. The streams north of the Platte, from Kearney to Fremont, have their courses first quite regularly south-east, then, as they near the Platte, they turn to the east-north-east, adopting the direction of that stream. Not only is this true of the Loup system, as Professor Hicks has well shown, but also of Shell Creek and Maple Creek further east.

2. There are dry channels, but little above the streams, connecting the Loup with Shell Creek, and Shell Creek with the Maple, which are known as Lost Creek and Dry Creek. These lie in the

same east-north-east direction, and are clearly analogous with the lower course of the Loup, where it connects its various branches. It seems not very improbable that the channel mentioned by Professor Hicks as connecting the South Loup with Wood River may be of the same sort.

3. The hills north of this compound channel, as it might be called, running parallel with the Platte, are of similar height and structure to those south of the Platte, but the hills south of the same channel are more than 100 feet lower, and of different structure. Both are capped with yellow loam of almost the same texture, but underneath the former have a well defined stratum of northern drift east of the meridian of Columbus, while the latter have but a faint trace of it mixed with deep stratified sand. These lower hills, moreover, are less eroded, and are evidently an alluvian terrace formed since the deposition of the older drift and the Loess. This terrace is seventy to ninety feet above the Platte, east of Columbus, and is more sandy and lower further west. The ancient north bank approaches the present Platte again, near Josselyn.

4. Corresponding in level to this high terrace, is an old channel crossing Saunders County along the valley of Sand Creek and in direct line with the upper course of the Maple. East of this is an area of bigher land between it and the Platte, which has been recognized as an "ancient island." It may be added, also, that this high terrace seems to be easily correlated with a terrace of



Drainage Map of Eastern Nebraska.

similar height and structure, found at several points along the Missouri, which may be referred either to the "Second Glacial Epoch" or to the time of the second cluster of moraines of that epoch.

The subjoined map exhibits most of the points mentioned above, as well as some knowledge of the drainage, and indirectly of the topography of the surrounding region.

These facts point strongly to the efficiency of the second influence mentioned by Professor Hicks, viz., "Pliocene channel filling," as the principal and sufficient reason for the peculiar arrangement of the Loup channels, rather than a secondary influence. This has been already pointed out by Professor Davis. The Loups did formerly flow through to the Platte, but at a time when it or a portion of it occupied the north channel already described, and when it was flowing on a level seventy-five to a hundred feet higher, relatively, than at present, somewhat as it now occupies the channel north of Grand Island, and probably not long ago occupied a portion of Prairie Creek. The superabundant sediment, the shifting of the Platte to the south in obedience to Ferrel's law,— possibly reinforced by a tipping to the south, — and a deepening of its channel, which may have been partly due to a cutting through of a divide north of the "ancient island" into the lower channel of the Elkhorn, which, again, may have been accelerated by the recent eastward tipping of the region, are sufficient causes to explain the changes of the Platte, Loup, and associated streams since the disappearance of the waters which deposited the loess. The exceptional course of the Platte, however, from Kearney to Fremont, which we conceive was first taken about that time, remains unexplained. The causes which may be surmised are the following: 1. The position of a depression in the bottom of the Pliocene or Pleistocene lake, which may in some way have been produced by unequal deposition of its sediment, or the earlier unequal erosion or deposition of the subjacent formations whose strike here is approximately north-east. 2. A slight fold in the plains a little south of this course of the Platte. Of such no distinct trace has yet been found. There is a slight anticlinal axis crossing the Big Blue near Milford, but it is probably quite limited in extent. 3. This course may perhaps be a survival of a time when this region was tipped toward the north-east, because of the burden of ice which then rested upon Iowa, Minnesota, and eastern Dakota. This is but a conjecture, against which several objections arise, which it is needless to express.

In this connection, it may be helpful to call attention to a similar bend in the Arkansas in central Kansas, and to note that in each case the exceptional direction is upon more recent beds near, and parallel to their junction with, the upper Carboniferous. This may be a straw which would indicate that our first surmise may have some truth in it.

Concerning the efficiency of abstraction to change lines of superficial drainage, we may find considerable light from the study of this region. The remark of Professor Davis, that this rarely occurs where formations are nearly horizontal, seems well supported. Such is the slope of the country, and the porosity of the deposits, that the headwaters of the Big Blue rise a little below the level of the Platte adjacent, and the tributaries of Salt Creek rise below the level of the Big Blue near by, so that it is possible that water may leave the Platte between Kearney and Columbus, pass into the Blue, be drawn off into Salt Creek, and return to the Platte through the latter stream. And yet I know of no clear case of change of channel by abstraction in the whole region. The abundant sand, through the water flows underground, renders an open channel unnecessary. In fact, it may be argued that abundant sand tends to prevent the formation of superficial streams, unless there be first a velocity of flow sufficient to carry the sand easily, which cannot occur unless the flow is concentrated in some way. This is frequently noted in the sunken rivers of deserts. Possibly this may have had something to do with the exceptional course of the Platte before considered. Dunes form an important part of the divide between the Platte and the Little Blue south of Kearney.

One word further, regarding the comparative slopes of the Loup and Platte, to which Professor Hicks has called attention. Do we not find here examples of the law that declivity varies inversely as the quantity of water, as pointed out by Gilbert in his masterly paper on "Land Sculpture," in his report on the Henry Mountains? Although the Platte is much the more important river, by the time it has reached Kearney it is much reduced by evaporation and abstraction; then, because of its shutting off its tributaries by its abundant sediment, as before noticed, it is so reduced that it is often smaller than the Loup at their junction, even sometimes ceasing to flow above the surface, as I have been informed, while the Loup flows with a good current. On the other hand, the Loup is not so much exposed to evaporation, and has numerous tributaries, which having more frequently cut through the sand stratum, and on the lower side of its sloping basin, are more apt to be fed by springs than lose water by seepage.

J. E. TODD.

Tabor, Iowa, Feb. 29.

Estimates of Distance.

BESIDES the very interesting inferences drawn by Mr. Bostwick from his experiment (*Science*, Feb. 26, p. 118), one or two others should be suggested, in the hope that they may lead to some further investigation.

1. Is not an effect of fatigue shown in the eight or ten per cent by which the average observer's "mean deviation" from his own "average" is increased when the last ten of his thirty estimates are compared with the first ten? Should not this effect be greatest,— perhaps both appearing earliest and increasing most rapidly

with the number of observations made,— when the observer is quite untrained; while good previous mental training in things more or less analogous to those tested by the experiment might enable the observer to utilize promptly the practice being got in the experiment itself, and so might for a time overbalance the effect of fatigue? Thus, in the present case, the deviation increased most with the child A. L. B. and one other person, and decreased most with the artist L. F. and one other, but the data are too few to be more than suggestive. It would seem that further experiments upon the relation of fatigue, and of the effective practice got during each experiment, to previous training, etc., might be quite varied in direction and have some educational interest; the best training, *cæteris paribus*, being presumably that which best enables the trained to utilize fresh opportunities for training of a kind somewhat new to him.

2. The probable error of an estimated distance is, of course, some function of the distance and of other data; but *what* function of the distance, when the other data remain, as far as may be, constant? May it not be commonly taken as some low power of the distance whose exponent increases slowly with the distance? In the present case the ratio of the two distances tried is 4.37 : 1; and the average observer's mean deviation in inches from the truth, and from his own average estimate, respectively, are 2.69 and 2.56 times greater for the long distance than for the short; so that the exponent here would not be far from $\frac{2}{3}$.

J. E. Oliver.

Ithaca, N.Y., March 5.

Work and its Relation to Gaseous Compression and Expansion.

It is quite well known that the fundamental, and perhaps the most important hypothesis in theoretical meteorology is this, that work is done by air in expanding, and that heat is evolved whenever air is compressed. See "Recent Advances in Meteorology," p. 41. There is a most serious fallacy in this theory, however, in that it ignores the resistance against which the air expands, and considers that the mere diminution of the distance of the molecules of a gas, without the direct expenditure of external energy in changing this distance, can evolve heat.

An illustration will serve to make this clear. Take a cylinder one square foot in area and two feet high with a piston at the top and the air beneath it at atmospheric pressure. Place weights, pound by pound upon the piston, allowing all the heat developed to escape into the outside air. When we have added 2,160 pounds, the air beneath will be compressed to two atmospheres. Fasten the piston and its load, and connect the cylinder with another holding one cubic foot and containing air at normal pressure. An equilibrium will be quickly established and the pressure will be at 1.5 atmospheres in each cylinder. The potential energy remains the same as before; no work has been done and therefore there has been no change in temperature, except a slight chilling and heating due to the rush of the air from one into the other.

Return to the cylinder with the air compressed to two atmospheres and having the same temperature as the outside air. Take off the weight from the piston pound by pound, and the air will gradually expand, and in doing so will lift a weight, thereby doing work which cools the air very greatly, about 50° F. if the initial temperature was 60°. Instead of taking off the weight pound by pound, however, suppose the whole 2,160 pounds had been removed instantly. The only resistance which kept the air compressed has been entirely removed, and it is very evident that the air would expand without doing any work, if we consider that the piston moves back slowly; or, in other words, if we neglect the resistance of the air to the rapid motion of the piston, and hence there would be only a very slight chilling, owing to the work of imparting a certain velocity to the particles rushing out. The same result would have been attained if we had fastened the piston and its load, and then had turned a stop-cock, allowing the air to escape into the atmosphere without making a noise.

I am well aware that the ordinary interpretation of this illustration is very different; for example, Tyndall, in his "Heat as a Mode of Motion," p. 64, in a somewhat similar discussion, says: "The gas, in this experiment, executes work. In expanding it has to overcome the downward pressure of the atmosphere, which amounts to 15 pounds on every square inch, and also the weight on the piston itself. It is just the same as what it would accomplish if the air in the upper part of the cylinder were entirely abolished, and the piston had a weight of 4,320 pounds." I do not see that this changes the aspect of the case at all. Suppose that the air were compressed to two atmospheres beneath the piston, and that that was loaded with 4,320 pounds, while a perfect vacuum existed in the upper part of the cylinder, suppose that we suddenly remove 2,160 pounds from the piston. The piston, still having a load of 2,160 pounds, would fly to the top of the cylinder. How much work has the air done in expanding from two atmospheres to one? None at all. It looks very much as though the compressed air must have lifted that weight, but a little reflection will show that this is not the case. The best way to understand it, perhaps, would be to think of the weight after it reached within .001 of an inch of the top of the cylinder. Here is a weight of 2,160 pounds with the air under it at atmospheric pressure; in one sense the air sustains the weight, but if the air at atmospheric pressure sustains the weight at this point (the top of the cylinder), then the air at the same pressure would have sustained it at the middle of the cylinder. In other words, if we had allowed the compressed air to escape when the piston was at the centre of the cylinder, still with its load of 2,160 pounds and with a perfect vacuum above, there would have been an equilibrium, and we could have pushed the weight up and down, allowing it to stand at any point so long as the outside air had a communication with the lower side of the piston. Does not all this show that the compressed air, considered by itself, did not support any part of the weight at the middle of the cylinder, but was free to expand without lifting any weight or doing any work?

We are strictly taught that the old idea, "nature abhors a vacuum," is not at all tenable; but if we lay aside strict analysis for a moment and resort to this view, I think it will make the situation plainer to us. To all intents and purposes, when our piston loaded with 2,160 pounds had a perfect vacuum above it, we may say that it was sustained by that vacuum, or, at least, that the compressed air had nothing to do in supporting it or in moving it to the top of the vacuum. This seems to be quite an intricate problem, but a little reflection will show that the piston loaded to 2,160 pounds, and having a perfect vacuum above it, with air having free access to its under side, is in precisely the condition it would be in if both ends of the cylinder were open to the air and the piston without weight were located at any point in the cylinder. In this case the piston may be pushed up and down without meeting any resistance except that to the flow of the air.

Consider now the question of heated air rising in the atmosphere. We may simplify the problem slightly by taking a balloon, having an infinitely flexible envelope and without weight. Empty the balloon, and tie the neck so that no air can enter. It would require a pull of 15 pounds to the square inch to separate the sides of the balloon, owing to the pressure of the air. Incredible as it may seem, this is the force which theoretical meteorology has introduced into every discussion of the dynamical heating and cooling of the air, and of the cooling and heating of masses of air as they ascend or descend in the atmosphere,—a force which it is no exaggeration to say is at least 25,000 times as great as that really exerted or developed. Inflate the balloon one-third full with hydrogen gas. The work required to do this is that needed to displace a volume of air equal to the volume of gas which enters the balloon, or it would be that of lifting a weight equal to 1.2 ounces per cubic foot half the height of the balloon. It will probably be said that the outside air helps in this inflation, and I grant that for argument's sake.

Let the neck of the balloon remain open to the outside air, and suppose that the gas can just lift a weight attached to the balloon. The balloon will rise in the atmosphere to a point where the pressure is 10″, or until the gas has expanded to fill the whole envelope. Since the work of the balloon is open to the air, the pressure inside will continue exactly the same as that outside. A little reflection will show, however, that the conditions would be precisely the same whether the neck was opened or closed. The only work the gas would do in expanding would be that which it did in inflating the balloon, or it would simply displace a volume of gas equal to the enlarged volume of the balloon. It is easy to see that this work would be almost inappreciable.

It may help to clearness if we consider two balloons suspended by an endless rope passing over a pulley situated at the extreme height to which the balloon rises. This rope has no weight, and there is no friction at the pulley. One of the balloons is at the earth's surface, and the other at the highest point. The system is in equilibrium, and it would require but the slightest weight at the topmost balloon or a diminution of weight in the balloon at sea-level to disturb the equilibrium and cause the balloons to change places. It is very evident that throughout this motion the air sustains both balloons, and the work of expansion in one balloon or the work done by the air in compressing the gas in the other balloon would be almost inappreciable.

Instead of using hydrogen in our balloons we may use heated air and the results of the analysis would be exactly the same. Lastly, we may dispense with our envelope, and simply consider the heated air as rising in the atmosphere. As we have just seen, this air would do very little work, and the consequent cooling would be very slight; the converse would also be true, that the work of diminishing the distance between the molecules of the gas would be very slight, and the heating almost inappreciable so far as the compression was concerned.

The application of these views, if they shall be sustained, to nearly all theories in meteorology is very obvious. It has been only after the most careful study and analysis of all the questions involved, and a taking up and explaining all the apparent contradictions between the older views and these, that I have felt justified in presenting them so much in detail. I bespeak for them a most searching examination and criticism, hoping that thereby the whole truth may be established. H. A. HAZEN.

March 2.

Pyrite Incrustations of the Cretaceous Formations of Middlesex County, N.J.

ONE would scarcely expect to find beautiful mineralogical specimens in so uninviting a place as a clay pit. The specimens of pyrite incrusting wood and bark, that may be found in most of the clay pits of Middlesex County, N.J., are very beautiful, whether viewed æsthetically or as cabinet specimens. The incrustations as found near Ford's Corners occur in the black and dark-colored clays which usually overlie the lighter and better clays. This dark stratum of clay contains many remains of leaves, twigs, and bark, which have been partially changed into brown coal. Occasionally whole trunks are found which yield wood which may be wrought into a variety of ornamental objects which are capable of taking a good polish. As waters containing sulphates of iron come in contact with this carbonaceous matter the carbon unites with the oxygen of the sulphates and sulphide of iron is left in its place. In some specimens the pyrite is found covering the carbon, while in others the carbon has been completely replaced by pyrite; at the same time the form of the wood is perfectly retained.

Specimens having the form of twigs not thicker than a lead pencil, and having a fine crystalline surface, are occasionally found. These make very pretty breast-pins when suitably mounted. Some specimens look as though the material of which they were formed had been poured out whilst hot, and had spread on cooling much as hot lead does when poured out on a flat plate. Many specimens occur in the shape of balls as large as hen's eggs. These are made up of concentric layers of scale-like crystals formed about a nucleus at the centre. As these are exposed to the weather they scale off gradually, sometimes remaining bright until the balls disappear completely, while at other times they turn dark immediately.

The pyrite weathers very quickly when left exposed to the action of the air, and the clay waters. If, however, the specimens are collected and washed as soon as they are removed from their native beds, they will remain bright indefinitely.

Specimens are occasionally found weighing four or five pounds. When the pyrite is exposed to the weather in contact with sand or gravel, as the iron is changed to the ferric oxide it cements sand and gravel together so that very often the resulting conglomerate retains the form of the original lump of wood. Your clay-pitter does not look with a favorable eye on the "sulphur balls," as he calls them, for clay containing much sulphide of iron is worthless for brick-making.

Of late years large amounts of clay containing iron have been used for making the so called mottled bricks.

D. T. MARSHALL.

Metuchen, N.J., March 2.

AMONG THE PUBLISHERS.

THE American girl is not slow to grasp a chance. Some time ago *The Ladies' Home Journal* organized a free education system for girls, and the magazine is now educating some forty odd girls at Vassar and Wellesley Colleges, and at the Boston Conservatory of Music, all the expenses of the girls being paid by the *Journal*.

— The March number of *Babyhood* contains an article on "Getting the Teeth — First and Second," by the medical editor, Dr. L. M. Yale, which corrects certain misapprehensions as to the teething process and the troubles which are popularly supposed to accompany it. Similarly helpful medical articles are "The Care of Delicate Children," by Dr. H. D. Chapin, and "Cuts and Scratches," by Dr. H. Power. An alleged "sure cure" for diphtheria is also discussed by a competent writer. Of most general interest, perhaps, is a curious article on "What Shall be Done with Him?" — an account of a completely unmanageable though not at all vicious boy, which is sure to give rise to considerable discussion.

— We have received a copy of the American edition of "Longmans's New School Atlas," the joint work of George G. Chisholm of the Royal Geographical Society and C. H. Leete of the American Geographical Society. It contains thirty-eight double-page maps; but in many cases what is numbered as a single map is really a collection of two or three maps. The introductory maps illustrate the various physical and astronomical phenomena of the globe, the climates and vegetation of different regions and the distribution of races and religions, while the remainder of the book is mainly devoted to political geography. There are, however, several special maps illustrating the climate, geology, and industry of the United States and Canada, and one showing the several acquisitions of territory by the United States. Most of the maps are so colored as to show the elevation of the different sections of land above the level of the sea; which seems to us to be making too much of a very small matter. The selection of maps is very judicious, and the United States does not appear with such overweening importance as it does in most American atlases; though it receives as much attention as the British Empire, and much more than any other part of the world. The number of towns indicated on most of the maps is small; and though a school atlas ought not to be overburdened with town names, the present work would have been better if it had contained more of them. The maps are well engraved on excellent paper, and as a general atlas of the world for school use, the book is meritorious. It is published by Longmans, Green, & Co. of New York, at one dollar and a half.

— Professor David Starr Jordan makes the inspiring influence of a great teacher of science strongly felt in the account of "Agassiz at Penikese," with which he is to open the April *Popular Science Monthly*. The article contains many of Agassiz's own words, which reveal the master's spirit better than pages of description. An authentic account of what treatment the Catholic Church actually gave to Galileo and his discoveries and writings will be given by Dr. Andrew D. White in one of his Warfare of Science papers. Attempts have been made to disprove or explain away much of this ecclesiastical persecution, but Dr. White's statements are fortified by copious citations from authors of unquestioned orthodoxy, The same article tells just how far into the present century the Catholic Church held to the notion that the earth does not move, and shows that certain Protestant sects displayed much less wisdom by clinging to the antiquated delusion even longer. "Rapid Transit" is the subject of the sixth of Carroll D. Wright's Lessons from the Census. It contains much information concerning operating expenses, relative economy of motive powers, growth of mileage, etc. An interesting study of "Involuntary Movements," by Professor Joseph Jastrow, will appear. Experiments have been made in the psychological laboratory of the University of Wisconsin which show the reality and nature of the motions on which "muscle-reading" depends. Professor Jastrow's article is illustrated with tracings of such movements, and with a figure of the simple apparatus employed in taking them. "The Great Earthquake of Port Royal," which took place in 1692, will be described by Colonel A. B. Ellis. This account corrects certain erroneous notions of the occurrence that have long prevailed, and shows that the arrangement of the present town invites a repetition of the catastrophe. The article is illustrated. The last of the articles on musical instruments in the series on the Development of American Industries will be published in the April number. It is by Daniel Spillane, and traces the evolution of the manufacture of "Orchestral Musical Instruments" in America. The article is fully illustrated.

— Charles Scribner's Sons will publish at once Edward Whymper's long-expected book, "Travels Amongst the Great Andes of the Equator," which was announced last fall, but which they were unable to issue at that time. They have in press a new "Handbook of Great Archæology" (profusely illustrated), dealing with vases, bronzes, gems, painting, sculpture, and architecture, by A. S. Murray, keeper of Greek and Roman antiquities, British Museum. After a long delay Baedeker's "Upper Egypt" has at last been published in English, and is imported by Charles Scribner's Sons. It will be welcomed by all interested in that subject, whether travellers or students.

— Houghton, Mifflin, & Co. have published a book by the theosophist, Mr. A. P. Sinnett, on "The Rationale of Mesmerism." Mr. Sinnett is the author of "Esoteric Buddhism" and other works on theosophy, and in the present volume he professes to account for the phenomena of mesmerism, or hypnotism, on the principles of so-called occultism. He begins by rebuking the physicians and other scientific men for their refusal until very lately to study the phenomena in question or even to admit their existence; and it must be admitted that the rebuke is well deserved. The theories he advances to explain the phenomena are, however, of a very unscientific character. He asserts the existence of a magnetic fluid and also of a third principle in the nature of man, intermediate between the soul and the body, which he calls the "astral" principle; and it is by these imaginary agencies that he attempts to account for mesmerism. He tells us that there is an astral body, which "is quite visible when detached

CALENDAR OF SOCIETIES.

Biological Society, Washington.

March 5.—Fred V. Coville, Conditions affecting the Distribution of Plants in North America; Charles Hallock, The Physiology of a Pocoson; Vernon Bailey, The Homes of Our Mammals; Theo. Holm, The Flora of Nova Zembla.

Entomological Society, Washington.

March 3.—C. W. Stiles, The Histology of Ticks; T. N. Gill, The Larval Condition of Insects an Intercalated Stage.

Appalachian Mountain Club, Boston.

March 9.—Isaac Y. Chubbuck, Up North Tripyramid on Snow Shoes; Percival Lowell, An Ascent of Fuji.

Publications received at Editor's Office.

ARMSTRONG & NORTON. Laboratory Manual of Chemistry. New York, American Book Co. 8°. 144 p. 50 cents.
BLAIR, J. A. The Organic Analysis of Potable Drinking Waters. Philadelphia, P. Blakiston, Son & Co. 12°. 120 p.
BOWSER, EDWARD A. Academic Algebra. Boston, D. C. Heath & Co. 12°. 366 p. $1.25.
CHISHOLM AND LEETE. Longmans' New School Atlas. New York, Longmans, Green & Co. Imp. 8°. 38 Maps. $1.50.
CORNELL UNIVERSITY. Fourth Annual Report of Agricultural Experiment Station, 1891. Ithaca, The University. 8°. 499 p.
DORSEY, JAMES O. Omaha and Ponka Letters. Washington, Government. 8°. Paper. 127 p.
KARRER FELIX. Führer durch die Baumaterial-Sammlungdes k. k. naturhistorischar Hofmuseums in Wien. Wien, Eigenthum des Herausgebers. 12°. Paper. 355 p.
ORTON, EDWARD. Report on the Occurrence of Petroleum, Natural Gas and Asphalt Rock in Western Kentucky. Frankfort, Geological Survey. 8°. 233 p.
RUSSELL, STUART A. Electric Light Cables. London, Whittaker & Co. 12°. 332 p. Ill. $2.25.
SINNETT, A. P. The Rationale of Mesmerism. Boston, Houghton, Mifflin & Co. 16°. 232 p. $1.25.
TAYLOR, J. TRAILL. The Optics of Photography and Photographic Lenses. New York, Macmillan & Co. 16°. 254 p. $1.
THOMAS, CYRUS. Catalogue of Prehistoric Works East of the Rocky Mountains. Washington, Government. 8°. Paper. 246 p.
UNIVERSITY OF CALIFORNIA. Riverside Addresses, 1891. Berkely, The University. 16°. Paper. 74 p.
VERITY, JOHN B. Electricity up to Date. New York, Frederick Warne & Co. 18°. Paper. 178 p. 75 cents.
WINSLOW, ARTHUR. Report on the Coal Deposits of Missouri. Jefferson City, The Geological Survey. 8°. 226 p.

Exchanges.

[Free of charge to all, if of satisfactory character. Address N. D. C. Hodges, 874 Broadway, New York.]

For exchange.—A fine thirteen-keyed flute in leather covered case, for a photograph camera suitable for making lantern slides. Flute cost $27, and is nearly new. U. O. COX, Mankato, Minn.

To exchange; Experiment Station bulletins and reports for bulletins and reports not in my file. I will send list of what I have for exchange. P. H. ROLFS, Lake City, Florida.

Finished specimens of all colors of Vermont marble for fine fossils or crystals. Will be given only for valuable specimens because of the cost of polishing. GEO. W. PERRY, State Geologist, Rutland, Vt.

For exchange.—Three copies of "American State Papers Bearing on Sunday Legislation," 1891, $2.50, new and unused, for "The Sabbath," by Harmon Kingsbury, 1840; "The Sabbath," by A. A. Phelps, 1842; "History of the Institution of the Sabbath Day, Its Uses and Abuses," by W. L. Fisher, 1859; "Humorous Phases of the Law," by Irving Browne; or other works amounting to value of books exchanged, on the question of governmental legislation in reference to religion, personal liberty, etc. If preferred, I will sell "American State Papers," and buy other books on the subject. WILLIAM ADDISON BLAKELY, Chicago, Ill.

Wanted, in exchange for the following works, any standard works on Surgery and on Diseases of Children: Wilson's "American Ornithology," 3 vols.; Coues' "Birds of the Northwest" and "Birds of the Colorado Valley," 2 vols.; Minot's "Land and Game Birds of New England;" Samuels' "Our Northern and Eastern Birds;" all the Reports on the Birds of the Pacific R. R. Survey, bound in 2 vols., morocco; and a complete set of the Reports of the Arkansas Geological Survey. Please give editions and dates in corresponding. R. ELLSWORTH CALL, High School, Des Moines, Iowa.

For sale or exchange, LeConte, "Geology;" Quain, "Anatomy," 2 vols; Foster, "Physiology," Eng. edition; Shepard, Appleton, Elliott, and Stern, "Chemistry;" Jordan, "Manual of Vertebrates;" "International Scientists' Directory;" Vol. I. *Journal of Morphology;* Balfour, "Embryology," 2 vols.; Leidy, "Rhizopods;" *Science*, 18 vols., unbound. C. T. McCLINTOCK, Lexington, Ky.

To exchange Wright's "Ice Age in North America" and Le Conte's "Elements of Geology" (Copyright 1882) for "Darwinism," by A. R. Wallace, "Origin of Species," by Darwin, "Descent of Man," by Darwin, "Man's Place in Nature," Huxley, "Mental Evolution in Animals," by Romanes, "Pre-Adamites," by Winchell. No books wanted except latest editions, and books in good condition. C. S. Brown, Jr., Vanderbilt University, Nashville, Tenn.

For Sale or Exchange for books a complete private chemical laboratory outfit. Includes large Becker balance (200g. to 1-10mg.), platinum dishes and crucibles, agate motors, glass-blowing apparatus, etc. For sale in part or whole. Also complete file of *Silliman's Journal*, 1862-1885 (62-71 bound); Smithsonian Reports, 1854-1883; U. S. Coast Survey, 1854-1869. Full particulars to enquirers. F. GARDINER, JR., Pomfret, Conn.

from the physical body to those who are gifted in any high degree with clairvoyant vision," and that "the astral plane affords direct communion between the consciousness of the operator and the subject when the two are brought into true magnetic harmony." This explanation, as our readers will see, is no explanation at all; yet it is not a whit worse than the theory of "multiple personality" which is advocated by many French and German hypnotists. In our opinion the phenomena in question are far too intricate to be accounted for by any principles now known to us, and we believe that much more investigation and far deeper thinking are necessary before the true explanation can be given.

— The Cassell Publishing Company announce the "Record of Scientific Progress for the year 1891," exhibiting the most important discoveries and improvements in all the branches of engineering, architecture and building, mining and metallurgy, the mechanic arts, industrial technology, and the useful arts, photography, chemistry, medicine and surgery, printing, the generation, measurement, transmission, and application of electricity, the telegraph and telephone, meteorology and aeronauty, astronomy, etc. The editor is Professor Robert Grimshaw.

— M. Camille Flammarion, the author of "Uranie," is too well known to need more than the announcement of a new volume from his pen to attract readers. His new story, "Lumen," announced by the Cassell Publishing Company, is very much in the manner of "Uranie," a scientific romance. "It is a delightful thing in these prosaic days," says a well-known critic, "to get away from the novels of realism and strike out into something of an entirely different order that lifts one into the clouds — the pun is unintentional — and takes him away from the earth. It is just this that M. Flammarion does and it is a rest to the weary brain to read his graceful stories." Mrs. Serrano, who translated "Uranie," has translated this volume.

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SCIENCE

NEW YORK, MARCH 18, 1892.

THE PERSISTENCY OF FAMILY TRAITS.

NOT long ago we met a young friend, a bright, charming fellow, who said he was a student of ancestry. Having a weakness in that direction ourselves, we soon became engaged in conversation upon subjects of mutual interest until we remarked upon the extraordinary persistency of peculiar traits in members of the same family for long periods of time. To our astonishment he immediately informed us that the notion that there is such a thing as "family traits" had been consigned by all the leading genealogists to the realm of myths, and that there is positively no such thing to be met with in human experience. He proceeded to state that old people with active imaginations and defective sight and hearing thought they saw in their descendants the peculiar traits that in youth they had noted in their ancestors. Take from this, he says, the element of imagination, and there remains nothing but the recurrence of the traits of character common to humanity, and that once in a brief interval of time are emphasized in individuals.

He then produced a genealogical chart that showed the ancestors of A. B. through nine generations. A. B. was a direct descendant from L. B., who came from England early in the seventeenth century, about 250 years ago. The chart was of the usual semicircular form, with A. B. in the centre, and arranged in concentric semicircles, each semicircle devoted to a generation, with the right quadrant devoted to the ancestry on one side and the left quadrant devoted to those on the other. Of course, if such a chart was complete, as they very seldom are, the second semicircle would contain the names of two parents, the third of four grandparents, the fourth of eight great-grandparents, the fifth of sixteen, the sixth of thirty-two, the seventh of sixty-four, the eighth of one hundred and twenty-eight, and the ninth of two hundred and fifty-six. The whole number is five hundred and eleven individual ancestors of both sexes in nine generations. Assuming that no marriages took place between parties of even remote relationship, which is not likely to occur when the nine generations remain locally in the same neighborhood, the chart would show five hundred and ten ancestors, among which the direct line of B. comprised nine individuals, and occupied a perpendicular line in the centre of the chart.

"Now," says my friend triumphantly, "do you suppose that that line, mixed with nearly five hundred other lines, will preserve anything originally characteristic of it? The idea is preposterous." He continued further, "You will admit that ancestry consists of two elements, heredity and environment. In this case the environment has been the general conditions of New England farm and village life — practically the same; we can therefore leave that out. Now, heredity remains; do you suppose that anything peculiar remains in A. B. of any one of the two hundred and fifty ancestors from whom he is descended in the eighth generation from his own?" We answered, most emphatically, "Yes; and they would chiefly lie in the perpendicular line of B." To this declaration he dissented with equal emphasis, and appealed to the chart to prove it. We admitted that, as a geometrical demonstration, the chart was unanswerable, and urged without avail the fallacy of submitting a problem in biology and psychology to mathematical proof. The chart was, he assured us, the genealogist's compass and pole-star, from which there was no appeal.

Further conversation led to numerous citations of examples from our own knowledge and experience, which has been widely extended for many years among the descendants of John Doe. These examples, he assured us, were all mere coincidences that would cease to be examples beyond the range of the present generation; that, generally speaking, no man's knowledge extended beyond his grandfather, and that so-called family traits were eliminated by ignoring the great mass of dissimilars, and exaggerating the importance of the few similars. Finally, he challenged us to show that our examples proved anything beyond the observation of a few coincidences.

The problem briefly stated is this: Do persons bearing the same surname and remotely of the same family exhibit traits of character that are common, or in any sense to be considered as "family traits?" The facts within our observation and knowledge we believe to be susceptible of explanation upon a purely scientific basis of well-established principles, without any recourse to either imagination or chance coincidence. John Doe settled in one of the New England colonies about 250 years ago. The name is common among the middle-class English and is very old, one of the name having held a high ecclesiastical position in the thirteenth century, and others appearing among the lesser nobility a few centuries later. John Doe had a numerous family, of which five sons married, and have descendants now living in localities not far apart in New England and in many localities west of the Hudson River. There are descendants of these different brothers living as neighbors in several instances who do not know that they share a common ancestry. Now, it is or is not a matter of fact and observation whether these people, bearing a common surname and descended through from five to eight generations from a common ancestor, exhibit certain traits, or rather a combination of certain traits, which may be called in the aggregate a "Doe character." From our knowledge of the family taken as a whole, that is, the descendants of the five brothers taken together, we declare that there is an unmistakable "Doe character."

If you ask us to describe this character we must decline to do so. It is not necessary. Like all human character it is a mixture of good and bad. Moreover, it might be recognized, and we might be restrained from exhibiting our thesis with scientific clearness and precision. Again, there are subtle elements of human character that defy adequate expression in words, and yet are quickly recognized. Nevertheless, we will state how it has been proved to us as an individual: In the first place, by our own observation directed for several years by a knowledge of certain principles acquired in breeding animals; again by remarks made to us, neither solicited nor suggested by us, by members of the "Doe family," who had no knowledge of each other's existence, and who were separated by from five to seven generations; again, by similar judgments passed, not upon individual "Does," but upon the "Does" as a whole, by women who had married "Does," having no knowledge of each other's existence, and whose judgments had been passed upon different generations of "Does."

If "family traits" are a delusion to be explained away by the dilution of a geometrical chart amounting to one two hundred and fiftieth in eight generations, why can independent outside observers, the Does themselves and the women who marry Does, recognize a Doe character in the eighth generation? It is simply because heredity does not involve geometrical elements, in reality is only very inadequately represented by geometry.

Of what, then, does heredity consist? Of a vast number of extremely subtle influences determined by laws as yet but dimly comprehended, but few of which have as yet found adequate expression. Among others there are three laws or principles for which we do not know any name, but which, in their effects, are generally recognized among breeders of animals. First among these may be named the influence of race, which among breeders of animals would be equivalent to "a breed" and the varieties within it. A genealogical register of a family bearing a surname found among the seventeenth century settlers of New England may be fitly compared to the pedigree of any family of thoroughbreds, as, for instance, the St. Lamberts among Jerseys, or the Douglas among Ayrshires. It is often said that human beings are as to their breeding mongrels; but such a statement is not generally true, nor is it particularly true when applied to the better class of families who from the English middle class came to this country 250 years ago, and have here with a goodly showing of self-respect intermarried almost or quite exclusively in their own rank of social, religious, and political race. There has thus grown up under unwritten social customs a race, or breed, of New England citizens of pure English ancestry as carefully bred as to race and as to families within the race as any breed of thoroughbred cattle, a century older than the oldest breed in the world. Many of these families run back for several centuries in England before they emigrated to this country. We may, therefore, expect to find, and do find if we know where to look for them, the same effects of race that are observed in thoroughbred cattle, namely, persistency of race types as to the whole and of family types as to families. This persistency in the race is maintained through the persistency of the family type, and the family type is perpetuated by breeders through conformity with biological principles that, so far as is known, are active among all domesticated animals, and man considered as an animal.

It is a well-recognized fact that the first pregnancy of a female is of much greater importance as determining the character of her offspring than any and all others, and also that the influence of the male as determining the character of the offspring increases with each successive pregnancy of the female by the same male. Every breeder of cattle knows that a pure-bred heifer that is first coupled with a mongrel bull is ruined for breeding purposes, as the impression and characteristics of the first male will appear in the offspring of every succeeding pregnancy. A mare that is first coupled with a jack and gives birth to a mule will afterwards, when coupled with a stallion, give birth to horses with long ears and scant tails and saddle-marks across the shoulders and stripes upon the legs resembling mules. Horses marked in this way are very common in regions where mules are produced. A very handsome Morgan mare was once owned by an acquaintance of the writer that possessed unusual speed and great endurance. The condition of her udder showed that she had once borne a foal. She was coupled with a very fine thoroughbred stallion, and brought forth a perfectly worthless Canadian scrub, without a single characteristic of either parent.

Among human beings the infrequent marriage of widows as compared with the whole number of marriages renders a reference to examples in demonstration of this law of heredity somewhat difficult. Cases are not wanting, however, where women of high character have unfortunately married profligate first husbands, and have sought in a second marriage with men of honor to realize the happiness of which they had been deprived, only to see in bitterness the vices of the first husband return to curse them in the offspring of the second union. In less unfortunate marriages of this character the father fails to recognize in the aliens around his board either the virtues or vices of his kindred, and the personal appearance of his children is as foreign as their other characteristics.

The conditions under which animals are bred offer but few opportunities to demonstrate the increasing influence of the same male through successive impregnation of the same female. Among human beings illustrations are very numerous. Certain aspects of this case — perhaps the lowest — the marriage of colored women with white men and colored men with white women, are the most remarkable. Among the children of such unions the influence of the white man upon the colored woman produces a series of types with more or less strongly marked negro features and a successively lighter skin until a nearly white negro is produced, an example of which we once saw in Louisville, Ky., much more repulsive in appearance than a veritable negro. When a colored man marries a white woman a series of increasingly black children is the result. The children of such unions are in every sense mongrels, and are found to resemble in many respects mongrels among animals.

In every family that can be studied in successive generations the action of this principle explains many seemingly inexplicable facts. To go back to the descendants of John Doe, we have asserted without any fear of possible contradiction that there are "family traits" that may be observed among those who are separated from a common ancestor by six or seven generations. In one case among them a most extraordinary personal likeness was preserved through three generations. They were the fifth, sixth, and seventh generations from John Doe; they were the fifth, third, and fourth children of their respective parents. In the eighth generation the type was continued in the first child, but it is much less marked, and in the ninth generation, the son being the second child, with the influence of the mother very strong. Still, in both the eighth and ninth generations the Doe traits are unmistakably present. In the ninth generation the fourth child is a daughter, and generally admitted to be a Doe in every fibre of her being. Here is another case from the Does. In the sixth, seventh, eighth, and ninth generations a daughter has appeared in the relations of niece, aunt, great-aunt, and great-great-aunt. We have known them all. In the sixth generation she was the second child, in the seventh the sixth child, in the eighth the fifth child, and in the ninth the third child. They were and are all lighter in complexion than the others of their respective families, with a peculiar cast of features, resembling each other more than they resemble their mothers or sisters. They also possessed in common certain temperamental peculiarities, and their voices would instantly remind the hearer of each other.

Now to go back to our friend's chart, where the perpendicular line represents nine successive male Does. If every one of these eight male Does was a first child of each successive marriage, the Doe influence would be at a minimum and the transmission of the peculiar traits of the Does most feeble and uncertain. If each one of the eight was the youngest child in a family of six, the persistency of Doe traits would become more intense with each successive generation. For some purposes the tradition of the seventh son of the seventh son becomes something more than a mere superstition. If, however, in the third or fourth generation the surname was transmitted by a son whose father was the second husband of a widow who had borne children by a former husband, the family traits of the Does would doubtless be conspicuous by their absence. There have been no such marriages in the line of Does above mentioned for eight generations.

Too little is known concerning this subtle and intricate question to enable one to venture an estimate of the percentage of tendency towards family traits along the line of nine Does as compared with any other line from any given individual of the two hundred and fifty of the first generation from the ninth; but we think the challenge of our friend has been accepted and met, and sufficient proof has been submitted to show to any candid mind that a vastly greater proportion than one two hundred and fiftieth may be expected to flow along the line represented by the eight individuals who transmit the surname from the first to the ninth generations. Indeed, we think we are treading on solid ground when we assert that in the letters written by the Doe who was an ecclesiastic of the thirteenth century, and which have come down through six hundred years to the present time, the "Doe traits" are strikingly evident.

We should be gratified to learn if others familiar with other families than the Does are not fully satisfied that "family traits" are very persistent along the line of the surname.

AN ENQUIRER.

"SCIENTIFIC" GENEALOGY — A REJOINDER.

FROM the commencement of interest in the history of old American families the marked tendency has been, and is, for the chronicler to depart from the strict records, and attempt to trace reputed traits and oftentimes marked physical characteristics of the original emigrant ancestor and founder of the family through eight and nine generations, and connect the aforesaid qualities with the persons now bearing the surname descended from him. And a pride in one's ancestry is not reprehensible so far as these ancestors were healthy, energetic, honorable citizens, not less as honoring them than as taking satisfaction in the probably clear minds and strong constitutions we inherit, barring an untoward environment. But where the historian, considering a living person's little tricks of habit, peculiarities of appearance, and the like, ascribes these as in fact undoubtedly inherited from the original ancestor of nine generations previous, it becomes necessary to direct the attention of the sincere seeker for truth to certain self-evident truths, which are none the less patent and far-reaching, if comparatively unheeded and little studied in the past. To instance an average case: John Brown is a living person of the ninth generation from the first James Brown, who, we will suppose, came to this country about 1630. A simple mathematical computation shows that John Brown has had 510 distinct ancestors in these generations, of whom, at a liberal estimate, 50 may be duplicates owing to intermarriage of relatives. If there is a person in New England who can state his ancestry since 1630 completely with proofs, the writer, after some years careful research and acquaintance with men pursuing such study, has failed to discover him. As a matter of fact, the genealogist who has discovered and proved half his grandparents is exceedingly uncommon, and probably not one-twentieth of the persons who have chronicled the genealogy of a surname have known over 50 of their ancestors. They have paid, usually, almost their entire attention to the one surname in which they were interested and which filled their mind to the exclusion of the greater number.

In the writer's opinion he probably inherits from the 256 emigrant ancestors such a blending of qualities and physical characteristics, that to ascribe peculiar traits of any particular one of them to a living descendant is a fallacy, unsupported by reliable circumstantial evidence and persisted in in spite of the fact that the 255 other ancestors of the first American generation had qualities and traits of which he knows nothing, nor even the names of most; and probably, as far as the historian can surmise, each of the other 255 were fully as instrumental in bequeathing peculiar qualities, etc., as the one whose surname sexual distinction has given him. How does the matter look faced in the following manner? James Brown was one of 256 of John Brown's original American ancestors; is it likely or probable or a desirable thing for a genealogist to prove that $\frac{1}{256}$ part of the whole, when, as far as mortal can tell, all had probably much the same influence on the descendant, that this $\frac{1}{256}$ part has determined in a prominent and noticeable way the identity of the descendant? If one of the 256 were a person of color, an African, in the fourth generation, much more the ninth, the scientists tell us the color trace is well-nigh obliterated as far as discoverable. The writer does not for a moment combat the well exhibited inheritance of peculiar appearance and traits of a man from his father or mother, his grandparents or great-grandparents, or in rare cases from great-great-grandparents, but beyond these limits the historian has little to encourage him in his attempt beyond uncertain and traditionary tales.

The writer is descended from two ancestors, for both of whom the respective historians have claimed qualities and pronounced appearances of person, and remarked them prominently in all the living descendants; and the writer as yet fails to discover, after a candid if somewhat anxious self-examination, any of these characteristics. How often the mother's relatives fondly see clearly her look, her habits and character in a child for whom the father's family claim the self-same points; and the writer is familiar with the facts in a case where well-meaning friends have told parents of the strong likeness a child bore them, not knowing the child to be of entirely foreign parentage — adopted. My experience has been that a good part of the grounds for the side of the question I disbelieve in are as insecure as those just instanced. It is an old saying that one finds what he seeks for; that is, he thinks he finds it, which answers the same purpose for him.

To compare the human race to any of the brute creation as regards this question is unjust and mistaken, as in selection, cohabitation, and kindred vital processes, the cow — for instance, of Jersey or other strain — has the advantage of careful and long-continued selected inbreeding, where the human being is the result (even for nine generations) of over four hundred different stocks as against a very few mated in the case of the cow.

Such deductions as the writer opposes are, in his opinion, misleading, rest on unstable bases, namely, imagination and tradition, and are better avoided and the time better spent in legitimate genealogical work. To eke out with such matter what is feared will otherwise prove dry and without interest is unscientific and wrong. With the belief that this review, though hasty, may appeal to the common sense of the conscientious reader the subject is left, the writer believing a simple brief statement of fact preferable to a long and confusing rehash of unnecessary arguments.

Veritas.

A COMPARISON OF THE DESERTS OF NORTH AMERICA WITH THOSE OF NORTH AFRICA AND NORTHERN INDIA.

In a paper read before the Geographical Society of Berlin Jan. 2, Professor Johannes Walther made some interesting observations on the deserts of North America, North Africa, and Northern India. It was with the object of being able, from his own observations, to institute a comparison between these deserts that the author took the opportunity afforded by the meeting of the Fifth International Congress of Geologists of visiting the North American deserts.

The most striking contrast between the North American deserts and those of north Africa consists in the far greater wealth of vegetation which characterizes the former. In every direction the eye is met by yellow-blossoming halophytæ, silver-gray artemisiæ, and prickly cacti; between the opuntias are found cushions of moss, and at the foot of the hills juniper-trees seven feet high with trunks a foot thick. Such are the features of the landscape of the deserts of Utah, where plant-growth has completely disappeared only in those places where the saline composition of the soil kills vegetation. The Van Horn deserts in western Texas, the Gila deserts in California, are equally rich in vegetation; the altitude of those deserts above the sea level makes no important difference. Either the mean rainfall in the American deserts is greater than in those of Africa, or else the flora of the American deserts is better adapted to a dry atmosphere. Although the deserts of the two continents present fundamental differences as regards vegetation, there is a surprising similarity between them as regards certain important and characteristic desert phenomena, especially with regard to the topography of the country. There is the prevalence of plains, with mountains rising from them like islands, with no intervening heaps of *débris* passing from the plains to the steep mountain slopes. This phenomenon is the more striking as there are no rubbish deltas, even at the outlet of valleys 1,000 feet in depth. Another feature common to both is the large number of isolated "island" mountains and of amphitheatre formations in the valleys; also the intensive effect of insolation, which splits the rocks and flints, and disintegrates the granite into rubbish. The denudating influence of the wind is visible not only in the characteristics of the surface forms just mentioned, which differ in important points from erosion forms, but it can be directly observed in the mighty dust-storms which rush through the desert. In North America, as in north Africa, four types of denudation products are found — gravel beds, sand dunes, loam regions, and salt deposits.

In view of such agreement of important and incidental geological phenomena in regions so remote from each other, the phenomenon of desert formation must be considered to be a telluric process which runs its course according to law, just as the glacial phenomena of the polar zone or cumulative disintegration in the tropics. Water, which is such a predominating influence in temperate regions, destroying the rocks, dissolving them chemically, while the frost pounds them up mechanically, has in the deserts about sixty days in the course of the year to do its work of destruction among the rocks and to carry away *débris*. During the remaining 300 days of the year denudation in the desert is at a standstill, but not entirely. Small and large stones are split by the heat, and huge granite blocks are severed in two by immense fissures; and thus the rocks are destroyed by dry heat at a time when denudation by means of water is reduced to a minimum. In this way the process of destruction goes on in one form or other uninterruptedly throughout the whole year. The disintegrated material is then carried away by the desert rains or by the storms, which whirl great masses of loose matter high into the air and transport it further. It is clear, therefore, that dry denudation possesses an intensive power which, although not equal to the denuding effect of water, may be compared with it.

NOTES AND NEWS.

In the death of Thomas Hockley, which occurred on the 12th of March, in Philadelphia, the scientific institutions in that city have suffered a serious loss. Mr. Hockley was a member of nearly all the local learned societies, and as an officer of many of them did much to promote scientific work. As treasurer of the University Archæological Association, the Department of Archæology of the University of Pennsylvania, the Numismatic and Antiquarian Society, as well as of the Zoological Society and the Fairmount Park Art Association, he gave his services without pecuniary profit or even the prominence which he deserved, and he will be remembered as one who did much to advance public interests through self-sacrificing devotion to the general good.

— At the Berlin Geographical Society, on Jan. 2, Herr L. Cremer read a report upon the journey undertaken by him in the summer of 1891 to Spitzbergen, with the object of exploring the coal beds there. The author in the course of his six weeks' journey travelled along the west coast as far as Magdalena Bay, and found, besides the coal beds in Ice Fjord and Bell Sound, which were discovered by Swedish explorers, various other coal-veins which appear to be well worth working.

— In the second lecture of the Lecture Association of the University of Pennsylvania's course on "Early Religious Ideas," on Feb. 28, Mrs. Cornelius Stevenson spoke as follows: "The primitive animism of the men of the age of stone always remained at the foundation of the religion of Egypt, and continued to develop its superstitious practices, whilst the national faith had assumed an ever-growing metaphysical character. At the opening of history the Egyptians had already recognized the unity of the life-giving principle, but whatever may have been the ideas of their advanced thinkers with regard to the nature of the unity, there is no doubt that, to each local worshipper, the god he prayed to was strictly the god worshipped in his locality — and this did not exclude the recognition of the other gods. The whole structure of the Egyptian religion rested upon a belief in the divine nature of life, and, in its immortality through transformation, man could attain his immortality, not (in early times) through his merits, but through physical means. Hence the precautions taken to preserve the remains, and the statues made in his image, on which the spirit might lean in case his body should be destroyed. Metaphysical speculation on the nature of the universal soul grew out of solar worship, and, influenced by Aryan contact, at last superseded it. But even then the primitive animism, preserved in the cultus of the sacred animals regarded as incarnations of the divinity, although it assumed in the sanctuary a symbolic character, took a larger place than ever in the popular religion, and so it came to pass that fetishism was never more conspicuous in Egypt than at the time when the ideal absolute God, 'self-begotten,' had been realized in man's most noble thoughts, and been fitly described in man's most noble words."

— The death, on Feb. 20, of Professor Hermann Kopp is announced by *Nature*. He died at Heidelberg, after a long and painful illness, in the seventy-fifth year of his age.

— The friends of the late Henry Edwards have subscribed $10,000 and the American Museum of Natural History has subscribed $5,000 for the purchase of the Edwards Entomological Collection, consisting of more than 350,000 beautiful specimens of insect life, and this scientific treasure goes to the American Museum. The widow of Mr. Edwards will receive $15,000. This enterprise has been carried through by A. M. Palmer, and is one of the many good works done by that energetic manager and public spirited citizen of New-York.

— Two international scientific congresses are to be held at Moscow in August, as we learn from *Nature*. One will relate to anthropology and archæology, the other to zoology. There will be exhibitions in connection with both congresses, and appeals have been issued for the loan of objects which are likely to be useful and interesting. Among the things wanted for the Anthropological Congress are phonograms of the language and songs of different races. French will be the official language of the two meetings. The more important papers will be printed before members come together, so that discussion may be facilitated.

— The prevalent notion that the mistletoe is injurious to the apple or other tree on which it grows is disputed, says *Nature*, by Dr. G. Bonnier, the professor of botany at the Paris Sorbonne, who maintains, not only that this is not the case, but that it is actually beneficial to its host, the relationship being not one of simple parasitism, but rather one of symbiosis. He determined from a series of observations on the increase in the dry weight of the leaves, that, while in summer the mistletoe derives a large portion of its nutriment from the host, in winter these conditions are reversed, and the increase in weight of the mistletoe is less than the amount of carbon which it has obtained from the atmosphere — in other words, that it gives up to its host a portion of its assimilated substance.

— In order that the exhibition of weeds at the World's Columbian Exposition may be large and representative of all sections of the country, Byron D. Halsted, New Brunswick, N.J., having this feature in charge, asks for specimens of the worst weeds from all States and Territories. It is suggested that each botanist or local collector who may be pleased to assist in the work secure at least three specimens each of the worst weeds in his State or section. In making the specimens it is important that the following points be considered: 1. Seeds are especially desired; 2. seedlings are important in various stages of development; 3. the root system is essential, also, 4, the flower and flower cluster, and 5, the seed vessel. It may be necessary, therefore, to secure these various essentials at different times during the coming season. If the weed is a large one, stress is laid upon the procuring of specimens while they are small enough so that the whole plant, roots and all, can be mounted without bending upon an herbarian sheet of ordinary size; that is, not over a foot in length. They are not to be mounted, however, by the collector. That unnecessary duplication may be avoided, persons who contemplate collecting specimens should signify their intention to Professor Halsted, and allotments will then be made, the assignments depending largely upon the locality. It is hoped that each State in the Union may be represented by specimens in this national exhibit of our worst weeds. The collecting must all be done during the present season, and the specimens sent in for mounting, labelling, etc., by Dec. 1.

—The January number of *Petermann's Mitteilungen* contains an interesting map, by Dr. E. Hahn, of the "Kulturformen" of the earth, showing the areas within which different methods of getting a living out of the soil are employed. Dr. Hahn discards the old-fashioned division into hunters, fishermen, shepherds, and agriculturists as containing a fundamental error; for these three successive "stages" he substitutes six "forms." The simpler forms may have been more widely spread in the earlier periods of the world's history, but all exist side by side at the present time, as methods of cultivation arising from the physical and climatic conditions of the regions in which each is employed. The simplest form is hunting and fishing. The large area which Dr. Hahn assigns to this form in North-eastern Europe and Asia is somewhat remarkable. Next comes what Dr. Hahn calls Hackbau, which we may translate by hand-tillage. This form is characteristic of Central America, the basins of the Orinoco and Amazons, tropical Africa, Further India, and the Malay Archipelago, with the exception of certain coast districts. Plantations, the third form, are found wherever coffee, rice, sugar, are grown on a large scale. Next comes what Dr. Hahn calls "our European and West Asiatic agriculture," characterized by the use of the plough, the employment of oxen as beasts of burden, and the growing of corn. Originating in Mesopotamia, this form has spread with but slight changes over all the more civilised parts of the world. With regard to the fifth form, cattle farming, Dr. Hahn states that the only circumstance which was considered characteristic of the shepherd's life was the fact of his being a nomad. This excluded all whose herds consisted of other animals than sheep or goats. Larger cattle require better food than could always be obtained on the march. He therefore puts all owners of herds in one category, whether nomads or settlers. They are spread over all Central and Northern Asia, and are found in Arabia, on the borders of the Sahara, in South Africa, and in certain portions of Northern Europe, America, and Australia. A curious feature is a long, narrow strip extending from Somaliland into South Africa at varying distances from the East Coast; by his own account, however, it should not have been reckoned to the cattle-farming regions, as the cowherds make little or no use of the milk given by their animals, which are looked upon as mere standards of value and wealth. The last is the elaborate form of cultivation in small plots, which is the only method by which the exhausted soil of China can be got to maintain its huge population.

— Dr. Ira Remsen, professor of chemistry in Johns Hopkins University, Mar. 11, addressed a communication to President Harper of the Chicago University, declining his invitation to a professorship in that institution. Professor Remsen's decision is the cause of great gratification in Baltimore university circles.

— Dr. C. W. Stiles, medical zoologist of the U. S. Department of Agriculture, has been elected foreign corresponding member of the Société de Biologie, Paris, France, to fill the vacancy caused by the death of Professor Joseph Leidy of the University of Pennsylvania.

— Joel Chandler Harris's new book, "On the Plantation," is said to contain fresh stories of Brer Rabbit, Brer Owl, Brer Buzzard, and other characters immortalized in "Uncle Remus." Much of the book, however, is understood to be the story of the author's own life, and it is described as a singularly fascinating narrative. E. W. Kemble has illustrated the book, which is to be published immediately by D. Appleton & Co.

— E. & J. B. Young & Co. of New York have sent us a copy of the "Star Atlas," for amateur astronomers, with explanatory text by Dr. Hermann J. Klein, and translated and adapted for English readers by Edmund McClure, M.A., M.R.I.A. It contains eighteen maps printed by E. A. Funke, Leipsic, and is published, under the direction of the Committee of General Literature and Education appointed by the Society for Promoting Christian Knowledge, London, at the low price of three dollars. The maps show all the stars from 1 to 6.5 magnitude between the North Pole and 34° south declination, and all nebulæ and star clusters in the same region which are visible in telescopes of moderate powers. The "Atlas" is an imperial 4°, strongly bound in cloth, with illuminated cover, and contains 72 pages of descriptive text, with 18 charts beautifully printed from heliographical reproductions of photographs. It is a model of its kind, being handy, compact, accurate, and of practical service to amateurs, comet-hunters, and students.

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THE NEW STAR IN AURIGA.

ON Feb. 2 of the present year Professor Copeland of the Edinburgh Observatory received an anonymous postal card upon which was written the following: "Nora in Auriga, in Milky Way, about two degrees south of Chi Aurigæ, preceding 26 Aurigæ; fifth magnitude, slightly brighter than Chi,"

In No. 1,164 of *Nature* the discoverer of the new star establishes his identity by a short notice of the manner in which he found the Nora. His name is Thomas D. Anderson, and he lives in Edinburgh, Scotland. The following is an abbreviation of his statement: —

"It (the star) was visible as a star of the fifth magnitude for two or three days, very probably even for a week, before Professor Copeland received my postal card. I am almost certain that at two o'clock on the morning of Sunday, January 24, I saw a fifth magnitude star making a large obtuse angle with Beta Tauri and Chi Aurigæ, and I am positive that I saw it at least twice subsequently during that week. Unfortunately, I mistook it on each occasion for 26 Aurigæ, merely remarking to myself that 26 was a much brighter star than I used to think it. It was only on the morning of Sunday, the 31st of January, that I satisfied myself that it was a strange body."

Mr. Anderson then, in a frank manner, speaks of his knowledge of astronomy and the instrumental means at his disposal Of the former he says, it is of meagrest description, while the latter consist of a pocket telescope and a copy of Klein's "Star Atlas."

Since discovery the new star has been very generally observed at all the prominent observatories in Europe and America. The telegram announcing the discovery was received at the Naval Observatory on the afternoon of February 6. I observed the star the same evening with our 4-inch comet-seeker. To me it then appeared about half a magnitude brighter than Chi, and was of a dark straw color. Using a low power eye-piece, I could bring both Chi and the new star into the field at the same time. With the meridian transit I observed the star for its Right Ascension, and Professor Frisby, with the 9-inch equatorial, determined its declination. The large transit circle is now dismounted, undergoing repairs prior to its removal to the new Observatory. The place of the star for 1892.0 is, R.A. 5 h. 25 m. 3.4 s.; Dec. $+30° 21' 41.0''$. The magnitude was 4.6.

Professor Copeland, upon examining the star with a prism between the eye and the eye-piece of the 24 inch reflector, observed that it seemed to possess a spectrum very much like that of the Nora of 1886, the recognized variable, named Tau Coronæ.

The star was photographed at Harvard College Observatory on Dec. 1, 10, and 20, two months before it was known to be a new star. This came about by Prosessor Pickering and his assistants photographing the region of the sky in which the Nora is located in the course of the photographic mapping of the stars and their spectra now being carried on at Harvard College Observatory. On the 1st of December, 1891, the Nora was faint, on December 10 bright, and on the 20th maximum. Spectrum unique. The above is a statement given out by Professor Pickering.

From No. 3,076 of the *Astronomische Nachrichten* we glean the following interesting points relative to the new star. At Bonn, Feb. 2, Professor Kustner made a careful comparison of the magnitude of the Nora with three neighboring stars. He estimated it as half a magnitude fainter than Chi, little, if any, brighter than 14 Aurigæ, and decidedly brighter than 26 Aurigæ, the resulting magnitude being 5.5.

The region of the sky in which the new star is located was examined for the Bonn Durchmusterung by Schonfeld, March 26, 1856, and Kreuger, Feb. 16, 1857; also again by Kreuger in the revision-zone, March 23, 1858, on which date he observed a star of the 9.5 magnitude distant from the place of the new star 2.5s. and 0.8′. This faint star has, however, been observed anew at Bonn and Hamburg.

At Upsala on Feb. 2 its magnitude was estimated as 5.5, and its color as yellow. On observing its spectrum a very bright line was seen at the red end, and another in the blue-green. On Feb. 3 the star was almost as bright as Chi, but the next night it was fainter.

At Kiel, Mr. Kroeger observed the spectrum on Feb. 2. It was brilliant and visible throughout all the colors from the red far into the violet. A broad, black band was seen near C. In the red and orange there were three groups of lines, separated by equal intervals and of nearly equal width and intensity, all wide, but faint.

Mr. Yendell, living near Boston and an expert in variable star observing, is authority for the statement that between Feb. 9 and 22 the star appeared to him of a bluish white color with no tinge of red. This observation of the color of the star is directly opposite to that reported by the English and German observers, and also that of mine made on several occasions. The star has each time that I have observed it, ten or twelve times, always appeared to me of a dark straw color. I have observed it with two instruments, the 4 inch comet-seeker and the meridian transit. Mr. Lockyer, the English spectroscopist, has secured several photographs of the spectrum. He estimated the color of the star as reddish with a purple tinge. Mr. Fowler, one of his assistants, estimates it as reddish yellow; while another, Mr. Baxaudall, estimates it as purplish.

Mr. Lockyer, commenting upon the photographs taken on Feb. 7, says, "The bright lines *K*, *H*, *h*, and *G* are accompanied by dark lines on their more refrangible sides. With the 10-inch refractor and Maclean spectroscope, C was seen to be very brilliant, and there were four very conspicuous lines in the green. Several fainter lines were also seen, and a dark line was suspected in the orange. Mr. Lockyer noticed that some of the lines, especially the bright ones near F on the less refrangible side, appeared to change rapidly in relative brightness, and this was confirmed by Mr. Fowler. All the lines in the spectrum of the Nora are broad, although in a photograph of the spectrum of Arcturus, taken with the same instrumental conditions, the lines were perfectly sharp. It is also important to note that the broadening of the lines is not accompanied by any falling off of intensity at the edges, as in the case of the hydrogen lines in such a star as Sirius.

Judging from the testimony here given, it is undoubtedly true that a new star has appeared to our vision, and given astronomers an opportunity to study its make-up. It cannot, however, be said that the object has suddenly come out to its present magnitude. The probability points to the fact that the new star is a variable of long period, and one that at its minimum sinks to invisibility. The verification of this statement must rest upon future observations. We have no record that indicates that a star as bright as the tenth magnitude has ever occupied the place in which the new star has been found. All speculation as to its future history is valueless, because we know nothing of its past history.

The star is now being constantly watched by all the powerful telescopes and spectroscopes of the world, its image is almost nightly caught upon the photographic plate handled by men of experience, and it will not sink back into invisibility without leaving behind a record of great value.

GEO. A. HILL.

Washington, D.C., March 9.

THE TIMBER TREES OF WEST VIRGINIA.

THE Guyandot Coal Land Association, which is the owner of over 200,000 acres of land in the basins of the Guyandot and Twelve-Pole Rivers, in the Counties of Wayne, Logan, and Lincoln, near the south-west corner of West Virginia, has recently had the large timber trees on about 9,000 acres of land counted and measured, thus securing reliable information as to the actual present condition of the Trans-appalachian forests of that region. The diameter of the trees was taken, with calipers, at about four feet above the ground; then the length of the trunks suitable for cutting into logs or for long timber was carefully estimated by the eye of the skilful timber measurer. No trees were measured that were less than eighteen inches in diameter, except the hickories and locusts, which were measured from ten inches and upward. The detailed tables of this counting and measuring have been furnished me for inspection. I think that a summary of the detailed count of the results of the measurements on one single tract will be of interest to the readers of *Science*. For this purpose I select a tract of 655 acres on the top of the dividing ridge between the waters of the east and the west forks of Twelve-Pole River, two miles north-east of the new mining town of Dunlow on the Ohio extension of the Norfolk and Western Railroad, about forty miles by rail south-east from the Ohio River at the new town of Kenova, one named from the abbreviation names of the three States that are there adjacent.

About one-half of this particular tract of land, say 325 acres, lies on the east side of the dividing ridge, slopes from the divide and faces to the north of east, and drains into East Twelve-Pole River. The other 325 acres lies on the west side of the divide, slopes to the south of west and drains into West Twelve-Pole River. The crest of the divide is not far from 1,000 feet above the level of the sea. The following statement shows the whole number of large timber trees now growing on this tract of 655 acres, by kinds and exposures. This tract was found to have growing on it, 16,989 trees; an average of about 26 large timber trees to the acre.

Kinds of Trees.	Western Slope.	Eastern Slope.	Trees of Each Kind.
White oaks	1,256	730	1,986
Chestnut oaks	3,803	2,083	5,886
Black oaks	734	366	1,100
Red oaks	494	242	736
Hickories	1,556	991	2,547
Chestnuts	1,203	697	1,900
Locusts	148	59	207
Maples	224	106	330
Birches	159	174	333
Tulip-poplars	386	472	858
Pines	563	376	939
Lindens	93	74	167
Totals	10,619	6,370	16,989

The proportionate percentage of the hardwood trees of the above table, all those named except the tulip-poplars, pines, and lindens, is quite remarkable. The softwood trees are: 1,042 on the westward slope and 922 on the eastward slope, a total of 1,964, or less than ten per cent of the whole number of trees on the western slope, over fourteen per cent of those on the eastern slope, and nearly twelve per cent of the whole number of trees, leaving over ninety per cent of the westward slope trees and near eighty-six per cent of the eastward slope ones as hardwoods. So these hardwood trees constitute eighty-nine per cent of all the large counted and measured trees now growing on this tract of land. The figures of the table indicate that the large hardwood trees are more abundant on the westward exposure of the dividing ridge.

The record of the diameter and length of each of the trees embraced in the above list, that now lies before me, shows that most of these trees are of large size, the oaks ranging in diameter from eighteen to sixty inches, and in trunk length from twenty to sixty feet. The hickories range from ten to twenty-seven inches in diameter, and from fifteen to sixty feet in trunk length; the pines from eighteen to forty inches in diameter, and twenty to seventy feet in trunk length; and the tulip-poplars from twenty to sixty-six inches in diameter, and from thirty to eighty feet in trunk length.

JED. HOTCHKISS.

Staunton, Va.

THE SPECIALIST.[1]

"MANY scientific men of excellent reputation are to-day guilty of the crime of unnecessary and often premeditated and deliberately planned mystification; in fact, almost by common consent this fault is overlooked in men of distinguished ability, if, indeed, it does not add a lustre to the brilliancy of their attainments. It is usually regarded as a

[1] A few thoughts suggested by the address of the retiring president of the American Association for the Advancement of Science, delivered at the Indianapolis meeting, August, 1890, from which the quotations here given are taken.

high compliment to say of A, that when he read his paper in the mathematical section no one present was able to understand what it was about; or of B and his book, that there are only three men in the world who can read it." . . . "There is a strange and unwholesome prejudice against making science intelligible, for fear that science may become popular." . . . "There is an unfortunate and perhaps a growing tendency among scientific men to despise the useful and the practical in science, and it finds expression in the by no means uncommon feeling of offended dignity when an innocent layman asks what is the use of some new discovery."

The progress of science during the last half-century has been especially remarkable. We are enjoying the product of the mental endeavor of all the past; one forward step has been followed by another, until, in scientific attainments, we are far in advance of the broadest views held a century ago. The age of the earth, its motion and gravitation no longer cause excited controversies. The existence of fossils now occasions no alarm; whether found upon the mountain-top or in the depths of the sea, the explanation is equally satisfactory.

Geology, like the fabled giants of old, has taken wonderful strides; has stepped off, as it were, a thousand years at a pace, and the sermons inscribed on nature's tablets have quickened the understanding and broadened human conceptions. Our knowledge of astronomy and geology has enabled us to cast out the coiled serpent of superstition, and given us truth in its stead. Can the most fertile imagination conceive of loftier heights than chemistry has reached when it is able to measure the five-millionth part of a grain of our far distant sun?

The use of anæsthetics is almost entirely a growth of the last fifty years; like a beneficent angel, conquering pain, annihilating as with magic breath the sufferings of thousands of human beings. Witness now the electric light, and think in comparison of the feeble glimmer of tallow candles. Not many years ago even the lonely light-house tower afforded nothing better than tallow candles to guide the traveller on the storm-tossed sea. Until recently electricity has been like a wild ungovernable force, but skilful hands are bringing it more and more under subjection. It is taking the place of brawn and muscle. The courier is no longer needed to despatch our messages on land or by sea. Here and there it has been harnessed to the street railway, and its practical applications are numberless.

It is but a few years since we have had any definite knowledge of bacteria, but who now is not familiar with at least the depredations of these insidious foes? Foes we may well call them when it is estimated that four-fifths of all diseases of humanity are caused by these pathogenic microbes, and that they destroy more lives than war or famine, fire or shipwreck.

Who has enabled science, this second Hercules, to open nature's doors and bring forth her treasures? Who is it that has gleaned her truths and read her laws, but he who has made a special study of them? There is not a practical application of a force of nature and scarcely a material substance that we use which has not resulted from the experimental researches of specialists. Is it not the geologist who has told us the story of the earth? Is it not the chemist who analyzes the sun, the biologist who unfolds for us the life histories of our invisible foes?

It is obvious that a geologist must have worked in geology, that a botanist must have done special work in botany; and in order to have taken up special work they must necessarily have done elementary work. There must be a foundation laid before the super-structure of special work can be reared. There is no royal road to knowledge, and there is no short cut to special work. The disciplinary work which leads up to special work must be done by each individual for himself; skill in manipulation cannot be acquired at second-hand, and judgment is gained through experience alone. The specialist does not simply devote a few years to his chosen work, and imagine his investigations cease when he takes his Ph.D.; not at all; the devotion of a lifetime is bestowed on his speciality, which broadens out before him, luring him on with the mysterious charm of unexplored labyrinths. The work of the specialist is to investigate, to find out the truth. He must divest himself of all prejudice, and with unbiased mind "read from the manuscripts of God" the truths there written, whether found on the granite rock or in the story of embryonic life

In the simplest forms of life there is no specialization of organs. Take, for example, the amœba, which is but a tiny speck of protoplasm — an undifferentiated mass; having no organs of locomotion, no mouth, no stomach, it yet moves about, finds its own food, appropriates and digests it. How does it accomplish these complex operations? It moves by pushing out a tiny slimy thread of protoplasm, and the whole mass flowing after it; when it comes in contact with an object which will serve it as food, it flows over it, wraps itself around it, absorbs the nutritious parts, and flows away from the *débris*. Thus this little animal is at times all legs, again all mouth, and still again all stomach, but possesses no differentiated specialized organs This we call the lowest type of animal life; the higher we ascend, the greater the specialization, reaching its culmination in man. The stomach prepares the food, the blood distributes it, the lungs take charge of ventilation, the liver looks to sanitation; the heart is general manager, and the brain, if you please, cultivates "social science." It is plain to everyone that the work done by the amœba is extremely rudimentary compared with that accomplished by man. The amœba fulfils the two essential purposes of life, maintenance and reproduction; mankind does the same, but who can measure the difference in degree?

Is not the work of the general student and that of the specialist in a measure comparable to that of the lowest and highest types of life? The general student who claims an equal familiarity with all branches of knowledge possesses but the rudiments of each. And mark the interdependence of the most specialized organs! No one of them can carry on the work alone; and it is thus with the sciences, advancement in any one of them means general advancement of the whole commonwealth.

All organic life is built up of cells; take any herb, shrub or tree; its tissues are made up of individual cells: each cell is filled with protoplasm, and though the cell walls are apparently continuous, having no visible openings even under high powers of the microscope, it has nevertheless been found that infinitesimal streams of protoplasm extend from cell to cell, connecting the entire plant as with a sympathetic nerve into one continuous whole. And so there is an invisible cord which binds all nature into one harmonious unity. There is a kinship, a brotherhood, a great sympathetic nerve which runs through all branches of natural science. To the general student they may appear independent of each other, but the specialist digs down beneath the surface where the roots are found ramifying in all directions; meeting, overlaping, interlocking with each other.

What can the specialist in physiology do without some knowledge of physics and chemistry? Geology, zoology and botany are hedged with problems whose solution are interdependent. If the sciences are united as with a network, a specialist in any one of them must have some knowledge of those which claim near kinship with his own.

But the specialist is accused of couching his discoveries in language which is unintelligible, of being unpractical; of trying as it were to hide his light under a bushel. Are these accusations well-founded? Are they true? Is it reasonable to suppose that one who studies in nature's laboratories a lifetime should think it desirable to erect a wall about science lest it become popular? Are not specialists numbered among the world's great leaders? To whom is due the great advancement in medical science but to specialists, who in their laboratories patiently sought for answers to problems of whose importance the common mind has no conception? A few years ago a war of words waged high over the theory of spontaneous generation; who but the specialist was able to settle forever this formidable question. Did the world imagine for one moment that the investigations which resulted in the establishment of the "germ theory" would lead to practical results? Physicians, surgeons and boards of health but apply the principles elucidated by the specialist. Enter a laboratory and behold a specialist in the midst of his bacteriological investigations. Would the observation be likely to call forth predictions of practical results? You would see "cultures" under bell-jars, microscopes, and various apparatus; "but," you exclaim, "what bearing do they have on human welfare?" Under the supervision of the bacteriologist they touch the very heart of humanity, bidding it look to its drains and sewers, to its drinking water, to the air it breathes and the purity of its food. Our knowledge of disinfection comes from the same source; who can measure the practical results? Practical applications of investigations in *fungi* reach out to the horticulturist and the farmer, who anxiously look to the specialist for remedies against their microscopic enemies. When the results of the investigations of specialists radiate like the rays of the sun to all humanity, offering balm for its wounds, remedies for its ills, shall they themselves be deemed unpractical, having no concern for human welfare? When they stand face to face with nature and read the histories she has written on shell and stone, on land and sea; when they recognize the bond of union in the division of labor, shall they be charged with "deliberately planned mystification" of the truths they would gladly sow broadcast over the land? Specialization is a law of nature which is stamped on every blade of grass, and on every flower that blooms. Heredity emphasizes this law in every phase and form of life. If it were not so, no individuality would exist. The oak tree does not take upon itself the production of roses, apples or grapes, nor does the rose ever dream of producing acorns or of elaborating material which will ultimately form an oak tree. Each individual cell in every plant contributes to the building up of its own special tissue.

Suppose we take the musical notes of some grand symphony, and scatter them at random on the musical staff; rendition would create but jarring discords. Let a Mozart or a Beethoven place each note where it belongs, and the resulting harmony "wakens in the soul a feeling earthly speech can ne'er declare." May not mankind be compared to these musical notes, creating discord in society because the individuals are not so placed as to enable them to gratify their best and highest aspirations, to do their special work? Is it utopian to hope that each individual, like each note in a musical conception, may some day swell the grand choral of the universe?

MRS. W. A. KELLERMAN.

Columbus, O.

ON A RECENT DISCOVERY OF THE REMAINS OF EXTINCT BIRDS IN NEW ZEALAND.[1]

A DEPOSIT of moa bones, larger than has been found for many years, has just been discovered near the town of Oamaru, in the province of Otago, in the South Island of this colony. Their presence was indicated by the disinterring of a bone during the ploughing of a field, by the proprietor of which the circumstance was communicated to Dr. H. de Lautour of Oamaru. This gentleman, who is well known through his papers on the diatomaceous deposits discovered by him in his district, at once inspected the spot. Finding that the deposit was large, he first secured, through the kindness of the proprietor, the inviolability of the ground, and then telegraphed the information to the Canterbury Museum. I lost no time in proceeding to Oamaru with one of my assistants, and superintended the digging out of the bones in a systematic manner. The site of the deposit was at Enfield, some ten miles to the north-west of the town, on ground elevated several hundred feet above the level of the sea, in a shallow bayleted hollow, into which the unbroken surface of the expansive slope gently descending from the Kurow hills to the open vale of the Waireka (a stream that rises further to the west) has sunk here for some seven to eight feet below the general level, and which, proceeding with a gentle gradient valleywards, becomes a ditch-like conduit for a tributary of the Waireka. In the centre of this depression, which does not exceed ten or twelve yards in width; the ground was of a dark brown color, damp and peaty. On removing the upper layer of soil for a depth of three to four inches round where the bones had first been brought to the surface, and whereon was strewn abundance of small crop-stones, a bed of very solid peat was reached, and firmly imbedded in it were seen the extremities of numerous Dinornis bones, most of them in excellent preservation, though dyed almost black. Further digging showed that certainly many of the skeletons were complete, and had been but slightly, if at all, disturbed since the birds had decayed. Owing, however, to the close manner in which they were packed together, and especially in which the limbs were intertwined, it was rarely possible to extricate the bones in the order of their relations, or to identify with certainty the various bones of the same skeleton, each bone having to be extracted as the circumstances of the moment directed. In many cases, again, only the pelvis and femora could be traced *in situ*, the vertebræ and remaining leg-bones being indistinguishable in the general agglomeration. It seemed evident that the birds had not died in an erect posture, but more probably with their limbs bent under them or in the same plane with the body. In some instances, beneath the sternum were found, lying quite undisturbed, the contents of the stomach, consisting of more or less triturated grass mingled with crop-stones. The quantity of these smooth, rounded (chiefly white quartz) pebbles — in size from that of a bean to that of a plum — mingled with the bones was enormous, and would, if collected, have formed more than a cart-load. Except where the bones were, there were no pebbles of any sort, no small stones, nor even sand, anywhere around. The nearest place where pebbles of the same composition are to be found is, I was informed, several miles distant.

[1] From Nature.

Four trenches, or pits, in all, were sunk. The dimensions of the first, which was excavated entirely in peat, did not exceed three feet square and three and a half to four feet in depth. When it was exhausted of its treasure, a second search was made about twenty to twenty-five feet higher up the hollow. The dimensions of this pit extended to about seven feet square and to the same depth as the first. Two more trenches, a few feet part, were dug at about thirty yards still further up the depression. They were not so large as the other two, but they extended down to about the same depth, three and a half to four feet, the bottom of both being (as it was in the second) a bluish clay, with which, in the pit furthest up, was sparingly mingled a small deposit of the finest silt. In the first pit portions of both Cnemiornis and Hæpagornis bones were found in abundance, and remains of several hundreds of moas of all ages. It was from the second pit, however, that the largest deposit of moa bones was obtained, and the most perfect specimen of food remains from beneath a sternum. Here, also, numerous bones of the giant buzzard and of the great extinct goose were exhumed, and a cranium as large as, if not slightly larger than, that of Cnemiornis, but of a species with complete bony orbits, as in the Cape Barren goose, and indistinguishable from Cereopsis. Bones from other parts of New Zealand now in my possession, which I hope shortly to describe, indicate with certainty that several species of Cnemiornis formerly existed in this colony. Some of these bones are remarkable for their slender elegance, and indicate species less in size and lighter in build than Cnemiornis calcitrans. Among the bones so far examined, I have observed no remains of Aptornis, of Ocydromus, or of Notornis; but I possess an adult tibia of a rail smaller than Porphyrio melanotus, yet larger than any other existing New Zealand species. The tarso-metatarsus of a species of Anas, about the size of Anas finschi, the metatarsus and sternum of Apteryx Oweni, and crania of A. australis, are among the bones recovered at Enfield, in addition to the metatarsus of a Biziura, somewhat larger than Biziura lobata, the musk duck of Australia, an interesting species for which I have proposed the name of Biziura de Lautouri, after the gentleman to whom I am indebted for the acquisition of these bones. There are still other bones which I have not yet been able to identify. The Dinornis remains belong chiefly to the species elephantopus (of unusually large proportions), to ingens, and to rheides. Very fine specimens of pelves and sterna have been obtained, with numerous crania more or less perfect. In this second trench the excavation penetrated through the peat into a bluish clay charged with water (which was, indeed, reached in all the diggings at about four feet below the surface), and into this clay the bones just protruded, but no more. The osseous remains dug from the last two holes belonged to the same species as those from the others. Digging and probing the ground beyond the boundaries of the trenches showed us that we had exhausted their contents; while the probing of the ground in the neighborhood for a considerable radius around, and in other peaty spots not far off, failed to afford indications of other deposits.

The number of perfect femora of Dinornis brought away exceeded 600; a large number were so decomposed as to fall to pieces in the handling; while a great many others disintegrated, after removal from the ground, on exposure to the atmosphere. I believe I do not over-estimate, therefore, in saying that from 800 to 900 moas at least were entombed in this shallow hollow. So many moas (leaving out of the reckoning the other species of birds) could not by any possibility have found standing-room, however crowded together, in the entire area of the depression. It would appear evident, therefore, that they did not perish all at one time. To account for their burial in such numbers in areas so circumscribed seems to me at present impossible. That their bodies were entire when they were deposited is clear, from the presence in such abundance of the crop-stones, from the position of the bones, and from the finding of the intact contents of the gizzard. No stream of any size could find origin in the immediate neighborhood, and no stream which could have transported the entire carcasses of birds of such huge proportions as Dinornis ingens or D. elephantopus could ever have occupied this ravine-head without leaving traces of its action on the surface which would be visible to-day, or without washing away the very fine silt mixed with the clay on which the bones lie, in the bottom of the most upland of our excavations. None of the bones are waterworn. This little hollow was, in the early days of its present proprietor, very wet and boggy, and several springs have origin in it. If the moas made this a highway from one part of the country to another, it seems difficult to believe that birds so powerful of limb, and standing at least 10 to 12 feet in height, could stick fast in so shallow a bog; and to conjecture why eagles of powerful flight, slender rails, small ducks, and comparatively light-footed kiwis also should become ensnared. Driven by fire in the surrounding bush — which may have covered the country then, for the plough has, I am informed, brought to light the stools of many large trees at no great distance, while logs of wood were found among the bones — did they, in a struggle for life in a narrow space, trample each other to death? The presence of the strong-winged Harpagornis in considerable numbers seems to militate against this explanation, and no calcined bones have been discovered. An explanation offered some years ago, to account for the presence of a great number of moa and other bird bones in a somewhat similar situation in the Hamilton swamp — that during severe winters these birds congregated at the springs rising warmer from below, and were overtaken by a severe and fatal frost as they stood in the water — appears unsatisfactory in the present case, as there are numerous springs and equally boggy ground near at hand, round which no remains can be found, and so close to the sea such excessive frosts are now unknown. That these were individuals who, during an excessive drought, arrived at the springs too far exhausted to revive — an occurrence common enough in Australia — and that the water there was charged with poison, have also been offered as explanations. But the permanence of glacier rivers, highest in the hottest seasons, precludes the idea of animals dying of thirst in this island, or at all events in this locality so near to the great snow river Waitaki. Poisoned water-holes or exhalations of carbonic acid might be a sufficient reason, yet in those springs elsewhere where bones have been found chemical analysis has failed to detect any substance harmful to life in their waters at the present day. Not a single indication of human intervention was observed. No bones were discovered which had been broken in their recent state; neither kitchen-middens, nor remains of ovens or of native encampments, occur anywhere near the deposit.

One piece of egg-shell dug out of the highest trench is not sufficient evidence on which to base the supposition that the spot was frequented as a nesting-place.

At Glenmark, in the north of this province, the historic spot where the original (somewhat larger than the present) find of Dinornis reliquiæ was dug out by my predecessor, the late Sir Julius von Haast, the bones of numerous species of birds besides moas were found. Their occurrence in the situations where they were discovered, and the way in which they were lying — entire bodies with their sterna covering crop-stones *in situ* — have been explained by the supposition that the moas were overtaken by a fierce and sudden storm, and their entire carcasses piled by wind and flood into vast heaps, an explanation against which the presence here also of the same powerful buzzard and other flying birds rises as an objection. Yet there is nothing either in the situation or the disposition of the bones to make it impossible; still I cannot help feeling that that cannot be the true explanation which satisfies only one instance out of so many assemblages of dead birds of nearly always the same species in situations almost similar. I hope, however, that when I have made a thorough examination of all the localities where, and the conditions under which, moa remains have been found, in the light of the personal experience gained in the exhumation of the present deposit, and when I have completed the identification (on which I am now engaged) of the smaller bird bones associated in them with the moa bones, some light may have been gained on this at present mysterious episode in the history of the ancient Avians of New Zealand.

HENRY O. FORBES.

Christchurch, New Zealand.

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.*

On request in advance, one hundred copies of the number containing his communication will be furnished free to any correspondent.

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

Need of Physiology and Anatomy in Psychological Training.

IN a recent article in *Science*, by Dr. E. W. Scripture of Clark University, some valuable and practical ideas are advanced concerning "the need of psychological training," in which the necessity of a practical knowledge of physics is made clear. But no less necessary is a like knowledge of physiology and anatomy.

Physiological psychology is no misnomer for modern psychology, because it is as much if not more physiological than psychological. That, consequently, a somewhat extensive knowledge of physiology is a *sine qua non* for the thoroughly trained modern psychologist goes without saying; and this is as true whether there be sympathy or not with the modern view, for, in the latter case, the psychologist can hardly avoid discussing some of the results of physiology; and such discussions, to be trustworthy and valuable, must be based upon knowledge. And here is not meant mere book knowledge, but experimental knowledge gained in the physiological laboratory, otherwise when one speaks of sensations, reflex action, afferent and efferent nerves, etc., it is difficult to understand how he can have any adequate insight into the objective reality of these phenomena. It is not intended that any large amount of time be required for purely physiological laboratory work. A term's course, say of six hours a week, might be the minimum; in this case it is assumed that the student has a general knowledge of human and comparative physiology.

If the above requirements are necessary for one who proposes to study physio-psychological questions, it may be inquired further as to anatomical knowledge. That a proper conception of physiology is not possible without anatomy is so obvious as to be commonplace, and yet there are some who are serious students of physiological psychology who have no practical knowledge of anatomy. A general dissection of the body and special dissection of the sense-organs and brain, while it would require more time than the physiological course, would be well worth the extra trouble, since it is preliminary foundation-work, and is also necessary for the investigation of pathological clinical cases, some of which are of the highest importance for the physiological psychologist. For this and other reasons an elementary course in practical histology is necessary. Thus it is not clear how any student without practical knowledge of coarser and finer anatomy can study and discuss intelligently questions concerning cerebral localization, cranial and spinal nerves, spinal column, medulla oblongata, etc.

It may be objected that many of the facts learned in such a course of study would not be of direct utility, but this could be urged against almost any course of study. The value of such negative knowledge consists in serving as a sort of ballast in aiding the student in avoiding mistakes.

It may be said that if practical courses in anatomy and histology are requisites, why not also similar courses in pathology and psychiatry. It is true that these would be valuable; but there must be a limit; perhaps the student could take up individual pathological cases as they came in the course of his work, provided he has the physiological and anatomical knowledge of normal man before mentioned. It is assumed that the specialist in physiological psychology will read the writings of specialists in physiology, anatomy, and pathology when they treat of topics that bear directly on his own studies. To read such literature, appreciate the points of discussion, and make decisions as to weight of evidence, requires at least a practical elementary knowledge of the subjects.

But it may be objected that, with accurate book learning and good diagrams, one can gain sufficient insight without going to the trouble of taking the practical courses. This objection is more real practically than rationally, for many do not care for vivisection, and much less dissection. It is a well-known difficulty, common to medical schools, to obtain faithfulness in dissection. There seems to be a natural disinclination, not of the nature of dread or disgust that may appear on first entering the dissecting room, but quite another feeling, that is easier experienced than described. The physiological psychologist who has had no medical training is very liable to have a strong disinclination to practical work in anatomy, even if he believes in its utility and necessity. Then there is sometimes the feeling that it is so much easier and saves time to sit quietly in one's own room and study the books and diagrams.

It may be said that some good workers in physiological psychology have never had this preliminary training, but this is rather in spite of such training. As is well-known, many students of philosophy, having become dissatisfied with its methods and results, have turned their attention to experimental psychology, and have neither time nor opportunity to return to preliminary work, which they could have done had they known beforehand the subsequent direction of their studies.

The fact that the majority of leaders in the department of physiological psychology were previously physicians or students of medicine indicates the direction which the training in physiological psychology should take.

A. MACDONALD.

Washington, D.C.

Anthropology.

THE science of anthropology has so far progressed that it is desirable to keep a satisfactory account not only of its operations but of its resources. Under this head should be included: 1. Encyclopædic works, general treatises, annual addresses, courses of lectures, dictionaries, general discussions, and classifications of the science as a whole. 2. Societies, their organization, scope, history, enterprises, and publications, as well as annual assemblies, caucuses, congresses, national and international. 3. Periodicals, devoted as a whole or in part to anthropology. 4. Museums and laboratories, public and private, expositions and loan exhibitions. 5. Libraries, galleries, portfolios, etc., including instructions to collectors.

At this time it is desirable to know what is doing in each State along the line of anthropology. We all know pretty well the work doing in Massachusetts; but where should we look for the archæological and anthropological resources of Maine, New Jersey, Kentucky, Oregon, etc. There are in all the States societies of natural history, and it would be pleasant to know whether they discuss anthropological topics. Many private collections of great value are to be found in the States; who knows about them? Now I shall be delighted to have the following questions answered with reference to every State in the Union: 1. Name of society, publication, or collection, public or private, devoted to the whole or a part of anthropology. 2. The nature of this relation to the science with lists of printed books or references in print to these. 3. The name and address of the person who will be glad to give information.

O. T. MASON.

Smithsonian Institution, Washington, D.C., Mar. 11.

The Aboriginal American Tea.

COMMENTING on my recent query as to any recent use of *Ceanothus Americanus* as a substitute for China tea, Professor W. J. McGee of the United States Geological Survey writes me: —

"Your little note in a current number of *Science* on aboriginal tea is before me. The eastern portion of the Great Plains, including Iowa, Illinois, and parts at least of Missouri, Minnesota, and Wisconsin, is a favorite habitat of the so-called "red root" or "red-root tea" (Ceanothus Americanus); and during war times, when the prices of tea and coffee were prohibitory, so far at least as first settlers in that country were concerned, many substitutes were employed. The common substitute for tea was the red-root, and it was very largely used in this way. The commonest substitute for coffee was rye, usually mixed with a small quantity of the coffee berry, both roasted and browned in the usual way. I should say, perhaps, that the identification of *Ceanothus Americanus* is partly my own and may possibly be erroneous."

I hope we may have other such interesting and valuable replies.

JED. HOTCHKISS.

Staunton, Va.

The Date of Discovery of the Galapagos Islands.

I AM indebted to Dr. H. Wichmann, the editor of *Petermann's Mitteilungen*, for an answer to my question in *Science* of Jan. 15, 1892: "At what time were the Galápagos Islands discovered?" Dr. H. Wichmann kindly calls my attention to a paper on the history of discovery of the Galápagos Islands, by Timénez de la Espada, published in *Boletin de la Sociedad Geogr. de Madrid*, Oct.-Dec., 1891., XXXI., Nos. 4-6. From this it is evident. Dr. Wichmann writes, that the discovery of the islands, "Archipélago Encantado," was made the 10th of March, 1535, by Fray Tomás de Berlanga, Bishop of Castilla del Oro, whose report is printed in the paper.

G. BAUR.

Clark University, Worcester, Mass., Mar. 14.

CALENDAR OF SOCIETIES.

Philosophical Society, Washington.

Mar. 12. — B. Pickman Mann, An Attempted Solution of a Social Problem; Alex. S Christie, Remarks on the Diurnal Variation of the Barometer; G. M. Searle, On a Simple Form of a Double Image Micrometer.

Society of Natural History, Boston.

Mar. 16. — J. Walter Fewkes, The Moki Snake Dance.

Oriental Club, Philadelphia.

Mar. 17.—Cyrus Adler, An Account of his Recent Travels in the East.

Publications received at Editor's Office.

COLBERT, E. Humanity in its Origin and Early Growth. Chicago, Open Court Pub. Co. 12°. 409 p. $1.50.
HOOGEWERFF, J. A. Magnetic Observations at the U. S. Naval Observatory. Washington, Government. 4°. Paper. 99 p.
MARSH, C. C. Report upon some of the Magnetic Observatories of Europe. Washington, Government. 4°. Paper. 37 p.
U. S. NAVAL OBSERVATORY. Meteorological Observations and Results, 1883-1887. Washington, Government. 4°. Paper. 261 p.
U. S. COAST AND GEODETIC SURVEY. Results of Magnetic Observations at Los Angeles, California, 1882-1889. Part I. Washington, Government. 4°. Paper. 42 p.
——Early Expeditions to the Region of Bering Sea and Strait. Washington, Government. 4°. Paper. 14 p.
——International Geodetic Association, Ninth Conference. Washington, Government. 4°. Paper. 12 p.
——Notes on an Early Chart of Long Island Sound. Washington, Government. 4°. Paper. 4 p.
——On an Approximate Method of Computing Probable Error. On the Determination by Least Squares of the Relation between two Variables. Washington, Government. 4°. Paper. 16 p.
——On the Use of Observations of Currents for Prediction Purposes. Washington, Government. 4°. Paper. 12 p.
——The National Phototypes of the Standard Metre and Kilogramme. Washington, Government. 4°. Paper. 23 p.
——The Relation of the Yard to the Metre. Washington, Government. 4°. Paper. 5 p.
——Tides at Sandy Hook. Observed and Predicted Times and Heights during the year 1889. Washington, Government. 4°. Paper. 10 p.
WHYMPER, EDWARD. Travels amongst the Great Andes of the Equator; with Supplementary Appendix. New York; Charles Scribner's Sons. 8°. 2 vols. Pp. 486, 175.

BOOK-REVIEWS.

A Manual of the Steam-Engine. Part II: Design, Construction, and Operation. By R. H. THURSTON. New York, Wiley. 8°. $7.50.

THE first part of the "Manual of the Steam-Engine" we have already noticed. Its purpose was twofold: (1) the development of the mathematical theory from the simple form applicable to the Carnot engine to a form that would assist the mechanical engineer in following the flow of energy into the engine of practice and its conversion into power or loss in many ways; (2) the application of the principles of thermo-dynamics and the data obtained by experiment to the computation of the quantities of heat, steam, and fuel required for the production of power in a given engine, and the determination of the proportions of engine and distribution of steam that would give the best result.

But so much has been gained by experience, simply, in the dedesign and construction of engines, aside from the progress based on theoretical considerations alone, that the author has preferred Part II. of his Manual to cover the more usual methods of design, construction, and operation of the steam-engine. Part I. contains the scholastic foundation; Part II., the practitioner's super-structure.

The two volumes already issued, it is proposed by the author, are to be followed by a third, which shall contain working drawings of the latest and best modern machinery of this class. The third part will, therefore, provide an atlas of such drawings, with concise accompanying text.

After treating the portions of his subject which are recognized as belonging to mechanical engineering, our author, in the last chapter, treats of the financial element in the theory and practice of steam-engine construction. This is something quite novel, and Professor Thurston looks to his friends for such criticism as will lead to the further development of this branch of the subject. Designing for a minimum cost is a matter which every experienced member of the profession has constantly been compelled to consider; but scientific methods of computation of minima rarely have been known or practised.

SCIENCE

A WEEKLY NEWSPAPER OF ALL THE ARTS AND SCIENCES.

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SCIENCE

NEW YORK, MARCH 25, 1892.

THE PUMA, OR AMERICAN LION.[1]

THE puma is the only large, unspotted, native American cat. The general color of the fur is tawny, but on the under surfaces of the body it is whitish. The color of the central line of the back is darker than that of the sides and the end of the tail is dusky brown. The ears are black externally, with a central whitish area. The upper lip is white from the nostrils to the middle of the mouth, and at the latter point is a prominent black spot. The nostrils are flesh-colored. Baird compares the color of the puma to that of the Virginia deer, and states that it varies with the seasons as it does in the deer; that is, the summer coat is reddish and the winter coat grayish.

There is much variation in color among individuals of this species, but it has not been proven that this is correlated with the varying climatic conditions of its range. The occurrence of albino pumas in the Alleghany Mountains and in New Mexico has been reported, but not authoritatively.

Burmeister remarks on this point: "Very rarely individuals of this species of a brown, nearly black color have been found, while differences in color between yellowish-brown and yellowish-gray are not rare. I am aware that individuals nearly white and others nearly black have been observed, but I have never seen such myself."

New-born pumas are very different in appearance from the adults. Instead of being of uniform color, the back and legs are covered with large blackish-brown spots, and the tail is ringed with the same color. According to Dr. W. A. Conklin these markings disappear in about six months after birth.

The male puma in the National Museum is of the following dimensions: Head and body, measured along the curves, 53 inches; tail, 26½ inches; height at the shoulder, 22½ inches. Audubon and Bachman give the following dimensions of a male killed by J. W. Audubon at Castroville, Tex., Jan. 28, 1846. From point of nose to root of tail (whether measured along curves, not stated), 5 feet 1 inch; tail, 3 feet 1 inch; height of ear posteriorly, 3 inches.

The male puma measured by Azara was somewhat smaller, the head and body being $51\frac{1}{8}$ inches and the tail 29 inches. The system of measurement is not given.

The average dimensions obtained from these three individuals are: For the head and body, $55\frac{1}{24}$ inches, and for the tail, $30\frac{4}{5}$ inches; total, 85 inches.

I have found no authentic record of any individuals measured before skinning of which the dimensions were greater than those of Audubon's specimen mentioned above. The total length in that case was 8 feet 2 inches. There are, however, records of measurements of flat skins of greater size. I have myself measured a skin from Colorado in the National Museum, No. 19,906, of which the total length in a straight line is 8 feet 4 inches. Mr. Livingston Stone states that the skin of a puma killed on the McCloud River, California, "measured 8½ feet when stretched." The average total length of nine flat skins of adults in the possession of Mr. F. S. Webster of Washington is 7 feet 4 inches.

The area over which the Puma ranges extends from New England and British Columbia to the Straits of Magellan. On the Atlantic coast of North America the species has apparently not been found in the States of New Hampshire, Rhode Island, New Jersey, or Delaware. On our northern boundary I find no mention of its having been found in Michigan or Indiana. In Ohio it was extirpated prior to 1838, and probably more recently in Illinois and Indiana. I find no record of its occurrence in Nevada, but as it has been found in the surrounding States it seems improbable that it should be entirely absent there.

With these exceptions there are recorded instances, more or less numerous, of the occurrence of the puma in every State and Territory of the Union, dating from the beginning of the century. Like many other large American animals, however, the puma has retired before the advance of civilization, and in many of the more thickly populated States it is improbable that even stragglers could be found at the present day.

The puma occurs throughout Central America and in all parts of South America to the Straits of Magellan.

The first mention of the puma appears to be the remark in the letter of Columbus regarding his fourth voyage in 1502. In the narrative of his exploration of the coast of Honduras and Nicaragua he writes: "I saw some very large fowls, the feathers of which resemble wool, lions [*leones*], stags, fallow-deer, and birds."

There are also references to the occurrence of the puma in North America of very early date in the narratives of Laudonnière, Hariot, Coronado, Hawkins, and others.

The puma, regarded as a species, possesses in a remarkable degree the power of adapting himself to varied surroundings. He endures severe cold in the winter in the Adirondack Mountains and other parts of our northern frontier, and tracks his prey in the snow. He is equally at home in the hot swamps and canebrakes along the river courses of our southern States. In South America he inhabits the treeless, grass-covered pampas as well as the forests. In the Rocky Mountains, as I am informed by Mr. William T. Hornaday, he ascends to the high altitudes in which the mountain sheep are found. Mr. Livingston Stone saw tracks of the puma on the summit of Mount Persephone in California, at an elevation of 3,000 feet. Similarly, Darwin states that he saw the footprints of the puma on the cordillera of central Chili, at an elevation of at least 10,000 feet. According to Tschudi, the puma is found in Peru in the highest forests and even to the snow-line (though seldom here). A writer in the "Encyclopædia Britannica" states that "in Central America it is still common in the dense forests which clothe mountain ranges as high as 8,000 or 9,000 feet above the sea-level."

In these different regions the puma always selects for his abode such spots as afford some shelter, but we find him in the thickets and copses, rather than in the great forests. "Those panthers that we have observed," writes one of the naturalists of the Mexican Boundary Survey, "were always

[1] Abstract of a paper in the latest Report of the National Museum.

found in the most solitary places, generally where there were thick bushes, and in the vicinity of rocky spots, affording caverns for secure concealment, and in which to bring forth their young."

The puma seeks his prey chiefly at dawn and twilight and under cover of night, but he also sometimes hunts by day. The different species of American deer are his principal quarry, but he preys also upon smaller mammals. He will even feed upon the different species of American porcupines, despite their quills, which lacerate his mouth and face. Audubon and Bachman state that raccoons and skunks, as well as birds, form a part of his food, and that he will eat carrion when hard pressed by hunger. To this list Brehm adds the South American coati, agouti, and paca, and the rhea, or American ostrich. Dr. Coues and Yarrow state that in New Mexico and Arizona the puma kills hundreds of wild turkeys and has indeed broken up many of the former breeding-places. Pennant asserts that the wolf serves the puma for prey. This is improbable. Nevertheless, he reports that there was in the Museum of the Royal Society of London the skin of a puma which was shot shortly after it had killed a wolf.

Of the larger domestic animals, such as the horse and cow, the puma attacks only the young, but he will carry off a full-grown sheep from the fold, and not unfrequently preys upon the llama in South America.

In the less settled portions of America the puma has proved at times a great hindrance to stock raising. Kennerly states that in Sonora, Mexico, it kills many colts and calves, and is poisoned with strychnine by the herdsmen. Mr. C. H. Townsend remarks, in 1887: "It is practically impossible to raise colts in the Shasta County hills, California, on account of these pests. They destroy many hogs and young cattle also, but do not present so serious an impediment to the keeping of these animals as in the case of horses." I have recently received similar reports from other sources.

The puma does not ordinarily attack men, but, on the contrary, when surprised attempts to flee from them. Nevertheless it seems probable that some individuals, when strongly pressed by hunger, or moved by other unusual circumstances, may be emboldened to make such attacks. Hensel affirms that such is the case. Darwin states that he had heard of two men and a woman who were killed by pumas in Chili. McMurtrie mentions that a woman was killed by a puma in Pennsylvania, January, 1830. That the puma sometimes kills the hunter who has wounded him is doubtless true, as any wounded animal is likely to turn upon its persecutor, but this is quite different from an unprovoked assault.

It is the habit of the puma to spring upon his prey from an eminence, such as a ledge of rock or a slight rise of ground. If he fails to strike his victim, he seldom pursues it for any considerable distance. In northern regions, however, he sometimes pursues the deer when they are almost helpless in the deep snow. It was reported to Darwin that the puma killed its prey by jumping upon the shoulder and turning the head back with its paw until the vertebræ of the neck are broken or dislocated. Azara ascribes the same habit to the jaguar.

The female brings forth her young in some secluded spot. In the Adirondacks, according to Dr. Merriam, "the lair is usually in a shallow cavern on the face of some inaccessible cliff or ledge of rocks." "In the Southern States," says Audubon, "where there are no caves or rocks, the lair of the cougar is generally in a very dense thicket or in a cane-brake. It is a rude sort of bed of sticks, weeds, leaves, and grasses or mosses, and where the canes arch over it, as they are evergreen, their long pointed leaves turn the rain at all seasons of the year.

From two to five young are born at a time. Bartlett states that in captivity the number is usually two, but sometimes one. Their young are reared without difficulty. They are brought forth at the close of winter or early in spring in the northern parts of the United States, and at the beginning of summer in South America, that is at the end of December. The period of gestation is from thirteen to fourteen weeks. The young first open their eyes when nine or ten days old. Their total length when born is from 10 to 12 inches. Dr. Merriam is of the opinion that in the Adirondacks the puma does not breed oftener than once in two years.

The age which the puma attains in the state of nature is unknown. It may be remarked, however, that one lived in the Zoological Garden at Frankfort, Germany, sixteen years, one month, and nine days. It died from injuries received by accident, Oct. 13, 1878. Dr. W. A. Conklin states that the various species of cats live in captivity fifteen or sixteen years, but show signs of decay at twelve years.

Authoritative writers upon the habits of the puma in North America agree that the adults do not commonly or frequently make use of trees except when traversing precipitous cliffs or when pursued by dogs. Under the latter circumstances they do not climb into a tree, but jump upon the nearest branch, even though it be at a considerable distance from the ground. Rengger, in his "Travels in Paraguay," however, states that both the puma and the ocelot climb well, and that in the forest they make their flight not only on the ground, but also by springing from tree to tree. He tells us in another place that he once saw a puma chase a troop of monkeys through the forest by jumping from bough to bough among the trees. However incredible this may at first appear, it becomes less so when we consider the wonderful denseness of the South American forests, described by Humboldt and other writers.

The puma, like the cat, has the habit of scratching the bark of trees with its claws, for the purpose of sharpening or smoothing them. Having mentioned this habit as possessed by the jaguar, Darwin writes: "Some such habit must also be common to the puma, for on the bare, hard soil of Patagonia I have frequently seen scores so deep that no other animal could have made them."

Many reliable authorities are agreed that the puma does not ordinarily emit loud cries or screams, but Kennerly, one of the naturalists of the Mexican boundary survey, states that on one or two occasions the cry of the puma was heard at a distance, and Schott writes as follows: "After dark his mournful note is heard resounding through the solitudes of the deserts. The note, listened to once attentively, is apt to make a deep, lasting impression. The different native names, as pronounced in Spanish, sound very appropriately to the note, and it is likely that the cry of the animal forms the base of its names. The note itself is often several times repeated, with intervals of from two to four minutes. As night advances the cry is heard but rarely." He also writes: "A puma was killed on the Rio Bravo, between Fort Duncan and Laredo. During his struggle with the hunters and dogs he raised a terrible cry, twice or thrice, to express his rage, and perhaps also to give his family the notice of danger." Dr. J. A. Allen reports that he once heard the puma's cry near his camp in Montgomery, Colorado. Eliot likewise states that he heard the cry of the puma at night, while camping on the St. John's River, Florida. He did not, however, see the animal. Darwin states that the puma does not often utter cries. He writes: "It is a very silent animal, uttering no cry, even when wounded, and only rarely during the breeding season."

In captivity the puma purrs when pleased, after the manner of the cat, and the female has been heard to utter a mewing sound.

The flesh of the puma is eaten by certain of the South American Indians, and was likewise eaten by the natives of North America, according to Catesby. Darwin, who tasted it himself, states that it is white in color and has the flavor of veal. Numerous other explorers and travellers make the same comment. Azara says on this point: "I have known my peons to eat it in preference to beef, even when that meat was to be had in abundance."

The puma is known under a multiplicity of English names. Among these are panther, painter, cougar, catamount, wild cat, American lion, California lion, silver lion, mountain lion, and tiger.

The word *puma* is the native Peruvian name, according to Garcilasso de la Vega, La Condamine, Tschudi, and other authors.

Cougar is an English form of the word *couguar*, which Buffon derived by abbreviation from *cuguacu ara*. This latter word, lengthened to *cuguacuarana*, is, according to Markgrave, the native Brazilian name. Azara, however, states that the ancient name, used by the Guarani Indians of Paraguay was *güazúará*. Others called it yagüá-Pitá, meaning red yagūá, or *yagüatí* meaning white yagüá.

The word "painter" is a corruption of panther. It is unfortunate that this latter name has gained general acceptance in the United States, since the true panther is a spotted, Old World cat, very different in appearance from the puma.

The name mountain lion is not altogether inappropriate, as the puma somewhat resembles the female lion in color and general form. From the earliest days the puma has been called the lion (*Leon*) by Spanish Americans and the name is still used.

The names catamount, or catamountain, and wild cat have no special applicability to the puma. They have been used by English writers to designate the European wild cat (*Felis catus*) and lynxes, and by Americans have been applied to the lynxes of this country.

Besides those names which are in common use, there are some which have been invented from time to time by various authors, and are known to zoologists as "book-names." Buffon's name *Couguar* really belongs to this class, as do also the names Brazilian cat (die brasilianische Katze of Müller), the brown tiger of Pennant, and the red tiger (*Tigre Rouge* of Barrère).

As already stated, the puma is called the lion (*Leon*) by Spanish-Americans, while the jaguar is styled the tiger (*Tigre*). Early Spanish writers, however, did not always distinguish between the two, and sometimes mentioned the puma under the name of tiger, or used the name in some modified form, as red tiger, etc. Molina states that it is called *Pagi* in Chili, and according to Clavigero, it was known to the Mexicans as *Mitzli*.

The puma is the *Felis concolor* of Linnæus. This name has been adopted by subsequent authors, almost without exception. Schreber, however, has two figures of the species in his work on mammals, one of which is styled *Felis discolor*. Molina, in 1782, gave it the name of *Felis puma*, and Lessou, that of *Felis unicolor*.

FREDERICK W. TRUE.

ASTRONOMICAL NOTES.

A New Comet.

A VERY faint comet was discovered by Denning of Bristol, England, on March 18. Its position is, R.A. 22 h., 44 m., Dec. + 59°. The daily motion is north, preceding. The comet has been observed by Spetater of Vienna, and the following is his position: March 19.4338 G.M.T., R.A. 22 h., 46 m., 47.1 s , Dec. + 59°, 17′, 43″.

Winnecke's Comet.

Winnecke's periodical comet has been found and observed. The observation is from Vienna, and the following is the position: March 18.4041 G.M.T., R.A. 12 h., 43 m., 27.5 s., Dec. + 30°, 35′, 38″. It is of the twelfth magnitude.

New Planets.

A planet of the twelfth magnitude was discovered by Wolf on March 18. The following is the position: R.A. 11 h., 7 m., 20.6 s., Dec + 4°, 44′, 49″. A planet of the eleventh magnitude was discovered by Palisa on March 19. The following is the position: R.A. 13 h., 27 m., 0.0 s., Dec. + 9°, 55′, 9″.

G. A. H.

VENEZUELA AND COLOMBIA.[1]

M. CHAFFANJON, in a paper read before the Paris Society for Commercial Geography (*Bulletin*, Tome xiii., No. 4), has given a description of these countries and a narrative of the journeys he made there during the years 1889–91. Venezuela has about 750 miles of coast line. From the mouth of the Essequibo to Guiria Point, known also as Cape Peñas, opposite Trinidad, the coast is low and sandy, whereas from this point westward to the Gulf of Maracaibo it is in general high and skirted by mountains rising in some places to a considerable elevation. The chief exports of the country are coffee, cocoa, and tobacco, cattle, copper and gold. Colombia is very favorably situated, possessing about 600 miles of coast on the Atlantic and nearly as much on the Pacific. Its harbors are certainly not very accessible, but Cartagena might be converted into a safe and important port. The coasts are low and dry, or else swampy. The Sierra Nevada produces excellent coffee and cocoa, and travellers speak very hopefully of its minerals. Gold, copper, nickel, mercury and coal have been found. In the neighborhood of Lake Maracaibo and the peninsula of Coro coal is abundant, and rich springs of petroleum exist. At a distance from the coast the country consists of immense savannahs, on which grow here and there, like oases in the desert, clumps of the palms known in this part of America as *moriches*, which send down their roots perpendicularly into the soil, and by capillary action draw up the water to the surface, making the ground around them muddy and even dangerous. If from any cause these trees disappear, the soil soon becomes extremely arid. Large fortunes are made by cattle grazing, and the cultivation of sugar is also an important industry, herdsmen eating as much as three or four pounds daily of a kind of loaf made of sugar. On the high plateaus wheat, oats, maize, and potatoes are grown. Caoutchouc and resins of various kinds may be collected in the forests.

[1] From the Scottish Geographical Magazine.

NOTES AND NEWS.

The laboratory of experimental psychology of Columbia College is established in four rooms, occupying the upper floor of the president's house. These include rooms for instruction and research, and a dark room for the study of vision. A collection of apparatus has been secured at a cost of about $2,500, and this will be further increased during the present year. The liberal regulation recently adopted by the trustees makes it possible for men of science not connected with the college to use the laboratory and apparatus for special research.

— Mr. George W. Field of Johns Hopkins University has been appointed to the American table at the International Zoological Station at Naples for three months, beginning Sept. 1. The table is at present occupied by Professor Wilson of Columbia University. The Americans at the station in 1891 were Dr. C. W. Stiles, Mr. W. L. Russell, and Miss Julia Platt.

— Steps have been taken towards the organization of Alumni Associations of Johns Hopkins University in the North-west and on the Pacific Slope. Preliminary meetings were held on Feb. 22, at Madison, Wis., where nine graduates and fellows of the university, members of the faculty of the University of Wisconsin, were assembled, and at Berkeley, Cal., where eleven persons met. The graduates meeting at Madison were: C. H. Haskins (Ph.D., 1890), assistant professor of history; G. L. Hendrickson (A.B., 1887), professor of Latin; H. W. Hillyer (Ph.D., 1885), assistant professor of organic chemistry; W. H. Hobbs (Ph.D., 1888), assistant professor of mineralogy and metallurgy; C. F. Hodge (Ph D., 1889), instructor in biology; J. Jastrow (Ph,D., 1886), professor of experimental psychology; H. B. Loomis (Ph.D., 1890), instructor in physics; F. J. Turner (Ph.D., 1890), professor in history; C. A. Van Velzer (fellow, 1878–81), professor of mathematics. The graduates meeting at Berkeley were: Henry Crew (Ph.D., 1887), Lick Observatory; F. G. Hubbard (Ph.D., 1887), instructor in English, University of California; A. C. Lawson (Ph.D., 1888), assistant professor of mineralogy and geology, University of California; F. Lengfeld (Ph.D., 1888), instructor in chemistry, University of California; W. H. Miller (A.B., 1888), instructor in mathematics, Leland Stanford, Jr. University; E. M. Pease (fellow, 1884–85), professor of Latin, Leland Stanford Jr. University; G. M. Richardson (Ph.D., 1890), assistant professor of chemistry, Leland Stanford, Jr. University; C. H. Shinn (A.B., 1884), Niles, Cal.; M. D. Stein (A.B., 1886), Oakland, Cal.; W. I. Stringham (Ph.D., 1880), professor of mathematics, University of California; H. A. Todd (Ph.D., 1885), professor of Romance languages, Leland Stanford, Jr. University.

— Until the present century the policy of Europe, in dealing with crime and pauperism, was the best possible if the object had been to propagate and increase them both. The States of the New World necessarily copied many of the methods of the old. Unfortunately, along with much that was true and wise, they copied and perpetuated many old blunders. But with the advance of modern thought, especially with the enormous widening of the sphere of scientific knowledge, have come new and better ways of dealing with the defective, the criminal, and the pauper. To spread abroad and make popular the better ways in charity and reform is the object of the National Conference of Charities and Correction, which meets annually in one or other of our great cities, and will hold its Nineteenth Annual Session in Denver, Col., next June. It combines the best philanthropy of all creeds and all shades of political opinion upon the broad platform of humanity. Its programme for the year has just been issued, and is an interesting paper, its topics covering many of the social problems of the time. The membership of this conference is unique. It has no salaried officers and no selfish benefit to offer to anyone, so its doors are open to all the world; whosoever will may come in, on a footing of the most perfect equality. The fact that you are interested in its work, makes you a member, and entitles you to a seat and a voice in its discussions. Anyone desiring further particulars as to reduced railroad fare, hotel accommodations, etc., may address Alexander Johnson, secretary, Indianapolis, Ind., who will send circulars and answer inquiries.

— During the past two years a large number of variegated plants have been examined with reference to the presence of parasitic fungi by Byron D. Halsted, New Brunswick, N.J., who presented a paper before the Torrey Botanical Club Feb. 9. Attention was first called to the subject by a study of the foliage of a variegated ash, which had its leaves badly spotted with a species of *Coniothyrium*, while ordinary ash trees were free from the same fungus. Some of the variegated plants, both of the hardy sorts and those grown under glass, have been badly infested with leaf blights. Of the former may be named the delicate and popular bedding plant called plantain lily (*Funkia undulata*, var. *variegata*), several sorts of variegated pelargoniums and alternantheras. Among the most affected of the tender plants of the variegated class may be mentioned the *Aspedistra lurida*, var. *variegata*, *Ficus elastica*, var. *variegata*, *Abutilon Thomsoni*, *Codiœum*, sp. (crotons), *Dieffenbachia*, sp., *Hydrangea hortensis*, var. *variegata*, *Phrynium variegatum*, *Dracœna*, sp., etc. There seems to be no question that the variegated leaves are more susceptible, and that likewise the etiolated parts are the ones first attacked. The absence of green in a leaf, from this it is to be inferred, is a source of weakness, and upon this account the etiolated tissue is less able to resist the attacks of the fungus germs. Speaking generally, a variegated plant lacks capacity for the best work, and the gardener, in propagating a variegation, no matter how it may have originated, is propagating a weakened plant in so far as it has its normal amount of chlorophyll reduced. The fact that some sorts of the self-blanched celery have been found more susceptible to blights and decay bears directly upon this point. It is a pity that so many of our choicest variegated plants blight easily; it is, however, natural that they should do so. Even a fungus parasite will take the line of least resistance.

— At the last meeting of the Numismatic and Antiquarian Society of Philadelphia a number of the amulets recently presented to the Museum of the University of Pennsylvania by Mrs. John Harrison, who collected them during her recent journey in the East, were exhibited. Among others was a small stamped metal band with a Hebrew inscription, worn by Jewish boys in Cairo on their foreheads. The inscription reads: *Ben Pórath Jóséf*, "a young branch is Joseph" (Gen. xxii., 49), *Shaddai*, and "Jerusalem the Holy City." A green-stone talisman purchased at Jaffa bore an inscription in Arabic of Cufic type, reading "God is High." The hand gave rise to a discussion on the wide-spread use of the extended hand as a magical symbol. In Japan such a hand is frequently placed over the doorway as a charm, and its use in America was commented upon. The folk-lore collection comprising charms, games and a variety of objects in the University, receives constant accessions and is growing in interest.

— The *Bol. dell Instituto Geogr. Argentino*, Tomo xii. Cuad. v. y vi., contains a description of Tierra del Fuego by Dr. Polidoro A. Segers, who took part in an expedition in 1886, and since then has continued his observations during three consecutive years. The northern part of the island, explored by MM. Rousson and Willems, is covered with prairies, where no trees and few shrubs are to be found (see vol. vii., p. 536). To the south, however, of the line from Useless Bay to Cape Peñas the surface is clothed with forest, which gradually becomes more dense towards the south. Here the coast is more rugged and the shore is encumbered by rocks, harboring large numbers of sea fowl and a variety of molluscs. Fish also and seals are more abundant on the southern coasts. This difference in the animal kingdom causes a corresponding difference in the mode of life of the natives. Whereas in the north the Onas, or, according to Dr. Segers, Aonas, subsist on the guanaco and the *tucu-tucu*, a small rodent, the natives of the south, where these animals are seldom met with, are almost entirely dependent on the sea for their living. They catch seals with a decoy of seal skin stuffed with grass, which they draw through the water by a thong, imitating at the same time to great perfection the bellow of the animal. Birds they catch at night by torch-light, letting themselves down the cliffs by ropes of leather, and fish they take in nets made of sinews of the guanaco. In their dress and customs the southern Onas resemble their brethren of the north, with whom they are constantly at feud.

Their number, in consequence of frequent battles with their more numerous enemies, has been much reduced, and is now, probably, very small. They are very skilful in the use of the bow, and show some dexterity in the manufacture of arrow-heads of flint and glass and needles of bone, but they never make any improvements in their utensils and are utterly ignorant of art of the rude description generally found among savages. Tierra del Fuego is inhabited by six tribes of Onas, each of which speaks a particular dialect, though men of different tribes are able to converse together. Each man has his distinctive name, wherein the Onas differ from the Yaghan, who live on the Beagle Channel, and go out in their canoes to sell otter and seal skins to passing vessels.

— Among the most singular cats which have been introduced into Europe of late years are those known as the Siamese. They are coming into favor, and half a dozen old cats and several young ones in the kitten classes were exhibited last fall at the Crystal Palace show. The ground color of one was pale cream, slightly darker on the hind-quarters, the color of the extremities, that is to say, the muzzle, ears, and tail, and the four feet, being a very dark chocolate, approaching black.

— At a meeting of the board of directors of the American Association to Promote the Teaching of Speech to the Deaf, held at Washington, D. C., Jan. 18, it was decided to hold the annual summer meeting either at Manitou, Col., Lake George, N. Y., or at Northampton, Mass., and Mr. A. L. E. Crauter was appointed a committee to ascertain the relative advantages of these points. He reported to a meeting of the executive committee at the Parker House last week. The committee decided, after due deliberation, to hold the meeting from June 22 to July 1 inclusive, at Crosbyside Hotel, Lake George, N. Y. This will in no wise conflict with the proposed conference of principals and superintendents of deaf and dumb institutions in Colorado. At the meeting last week, Dr. A. Graham Bell presided. Among those present were Miss C. A. Yale, principal of the Clark Institution for the Deaf; Miss Sarah Fuller, principal of Horace Mann school, Boston; Prof. A. L. E. Crauter, principal of the Pennsylvania Institute for the Deaf, Philadelphia; Hon. John Hitz, superintendent of the Volta bureau, Washington, D. C., and others. The meeting adjourned subject to call of the president to hear the report of the committee of arrangements in regard to a programme.

— Mr. William Sowerby, the veteran and distinguished Secretary of the Royal Botanical Gardens, writes to the *British Medical Journal* the following note on his suggestion for adding to the number of alkaloid beverages by the introduction of coffee-tea: When walking in the Gardens of the Royal Botanical Society, Regent's Park, and noting the extent of the collection of living medicinal and economic plants of all climes and countries there brought together in one spot, it must have occurred to all of us how very small a number of plants, out of the vast store which Nature has provided, man has bound to his service, and the yet fewer he has taken the trouble to cultivate. During the march of the last half-century, in science, medicine, mechanics, steam, and electricity how little has been gained from Nature's stores. The artificial culture of cinchona is, perhaps, the most noted of the few. Again, any step in eating, drinking, dress, is so governed by habit or fashion that he must be a bold man who tries to turn the current. This is illustrated in tea drinking. Perhaps there is no one habit so universal; each people has its peculiar tea or closely allied beverage, and most of these have continued the same for many ages. In one it is cocoa, in others, coffee, and in many, tea; in a few special quarters of the globe nothing but *maté* is thought fit to drink, but in only one small district is coffee-leaf tea used. Now we all know that these beverages are found by man to be pleasant and agreeable to him by reason of their containing a peculiar principle called *theine;* but yet we do not always select for our use the part of the plant containing the largest percentage of *theine*, or cultivate the special plant with a view to afford us the most valuable part. For example, in coffee the leaves are said to contain 1.26 of theine, and the berries only 1.0 per cent, and yet over 110,000,000 of men use the berries, and only 2,000,000 the leaves of coffee, although 500,000 000 use the leaves of tea. Now the cultivation of coffee berries is very trying, precarious, subject to attacks of blight and unfruitfulness; in fact it follows the general line that the produce of fruit by cultivation is far more open to accident than that of the leaves, and very probably good crops of coffee leaves could be obtained at small cost in countries and localties where it would be risky or even impossible to produce berries. Here is a case open to a vast variety of people to solve, for there can be no reason why coffee leaves may not become a valuable item of culture in our warmer colonies and many parts of the world. The one most difficult item to move is to create the demand. Once start the fashion for "five o'clock coffee-leaf tea," and the thing is done, and many a fortune made. As to the peculiar flavor of coffee-leaf tea much depends on the manipulation of the leaf after it is taken from the plant. At the Botanic Gardens a variety of flavors have by treatment been produced from leaves off one plant, the general flavor being a kind of combination of coffee and tea so as to get both in one cup.

— The *St. Petersburger Medicinische Wochenschrift* gives a *résumé* of a paper by A. S. Ignatovski on the cause of death by hanging. He refers the rapid loss of consciousness after suspension to the retarded or arrested circulation in the brain brought about by the increased intra-cranial blood pressure. The effect of this impediment to the circulation is the same as in cerebral anæmia, for in both the nutrition of the brain suffers. It is therefore not, as Leofman teaches, an insufficient supply of blood to the brain, due to compression of the carotids, which interferes with the functional activity of the brain, but compression of the capillaries by increase of the intra-cranial pressure, which has this effect, and which occurs whilst the supply of blood remains the same, or even increases.

— We learn from *Nature* that a prize is offered by Schnyder von Wartensee's Foundation, Zürich, for the solution of the following problems in the domain of physics. "As the numbers which represent the atomic heats of the elements still show very considerable divergences, the researches conducted by Professor H. F. Weber on boron, silex, and carbon, regarding the dependence of the specific heats upon the temperature, are to be extended to several other elements, prepared as pure as possible, and also to combinations or alloys of them. Further, the densities and the thermic coefficients of expansion of the substances investigated are to be ascertained as carefully as possible." The following are the conditions: the treatises handed in by competitors may be in German, French, or English, and must be sent in by Sept. 30, 1894. The examination of the treatises will be intrusted to a committee consisting of the following gentlemen: Professor Pernet, Zürich; Professor A. Hantzsch, Zürich; Professor E. Dorn, Halle-on-the Saale; Professor J. Wislicenus, Leipzig; Professor E. Schär, Zürich, as member of the committee offering the prizes. The Prize Committee is empowered to award a first prize of two thousand francs, and minor prizes at its discretion to the amount of one thousand francs. The work to which the first prize is awarded is to be the property of Schnyder von Wartensee's Foundation, and arrangements will be made with the author regarding its publication. Every treatise sent in must have a motto on the title-page, and be accompanied with a sealed envelope bearing the same motto outside and containing the author's name. The treatises are to be sent to the following address: "An das Praesidium des Conventes der Stadtbibliothek, Zürich (betreffend Preisaufgabe der Stiftung von Schnyder von Wartensee für das Jahr, 1894)."

— John Wilson & Son, Cambridge, announce "Selections Illustrating Economic History Since the Seven Years' War," compiled by Benjamin Rand, Ph.D., assistant in philosophy, Harvard University. This is a second edition, revised and enlarged. The first edition of these selections was published as a text-book of required reading to accompany a course of lectures on economic history given at Harvard College. It was also adopted for a similar purpose by other American universities. A continued demand for the work has led to the preparation of the present edition. The design of the book has been to exhibit in a series of articles of permanent value different phases of economic thought, and to present in chronological order a narrative of some of the more important events and influences of modern economic history.

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CURRENT NOTES ON ANTHROPOLOGY.—II.

[*Edited by D. G. Brinton, M.D., LL.D.*]

Prehistoric European Migrations.

LITTLE by little the seemingly impenetrable veil which shrouded the wars and wanderings of European nations before history began is lifting. Scientific methods undreamed of half a century ago now reveal the secrets of ages too remote to date. We can trace man in western Europe steadily advancing through the development of a continuous culture from the rudest period of chipped implements of stone to an epoch when he learned to polish and bore that material, and finally threw it aside to arm his hand with a blade of glittering bronze.

The continuity of this development is one of the master generalizations from the long labors of Worsaae, Mortillet, and others. It has recently received further solid support in an excellent critical study by Dr. Sophus Müller, entitled "Instruments Tranchants de l'Ancien Age de Pierre," published in the *Mémoires de la Société Royale des Antiquaries du Nord*. It is especially devoted to the use of the triangular stone celts found abundantly in Denmark. They are shown to be tools, and to belong to the earliest stone age of that portion of the continent.

Neither they nor any of the relics from northern Europe carry us so far back in the past as some from France and the Iberian Peninsula. This fact leaves little room for doubt but that these latter regions were inhabited first. Even there the advent of man must be placed as a post-tertiary event. This is the mature opinion of such authorities as Topinard, Cartailhac, and especially of M. Alexandre Bertrand, whose excellent book, "Nos Origines," has recently appeared in a new edition. M. Bertrand is director of the National Archæological Museum at St. Germain-en-Laye, and a most conscientious student. From his and others' observations it appears that matters went smoothly enough in Europe down to Neolithic times; but then widespread migrations began. More than 1200 years B.C., thinks M. Bertrand, the Ligurians came down from somewhere up north, and conquered portions of the littoral of Spain, Gaul, Italy, and Sicily. The interior of France and the Iberian Peninsula was then peopled by "Iberians." Not far from the date mentioned these were driven westward by inroads of the Celts. He acknowledges, however, that there are no relics positively attributable to either Ligurians or French Iberians; and his theory therefore must be accepted as only one degree less unlikely than the purely gratuitous one of Virchow, who makes out the Ligurians to have been "Turanians."

In recent numbers of the *Globus* and *Ausland*, Karl Penka urges with renewed vigor his theory that Scandinavia was the original home of the Aryan stock; and that not very long before the beginning of our era the whole of central Europe was peopled by Celts. He has an earnest disciple in E. Krause, who lately issued a volume of nigh 700 pages on "Tuisko-Land," his name for Scandinavia, to which, with great wealth of learning, he traces both the myths of Hellas and the simple cults of pristine Rome.

Another ethnologist with his own notions is Dr. Theodore Köppen, librarian of the Imperial Library at St. Petersburg. In a pamphlet reviewed at length in the *Archiv für Anthropologie* (Band xx.) he insists that the Finnic and Aryan linguistic stocks are one in origin; that their ancestral home was somewhere about the region of the middle Volga; that the separation took place into eastern and western branches on the river Don; and that at that time arose the Aryan and Ugro-Finnic divisions. His arguments are principally linguistic, and he lays especial stress on the words for "honey" and "linden bast," which he finds the same in the two stocks. His work is principally interesting as showing the growing tendency among scholars to discard the old theory that the Indo-Europeans began in Asia, in favor of an origin in Europe; but Köppen repeats the familiar error of attributing the theory of the origin of the white race in Europe to Dr. Latham; whereas, long before he mentioned it, it had been urged with clearness by Omalius D'Halloy, the distinguished Belgian anthropologist.

Retrogressive Culture in Prehistoric Times.

The general law of the continuity of development holds good throughout historic and prehistoric time; but the careful archæologist will always bear in mind that, in both, periods of retrogression have occurred in many localities; and he will not, therefore, assign to relics of man's industry a later date solely on the ground of higher technical perfection. Often a tribe or nation has been conquered or destroyed by one ruder though stronger, and for generations a lower has followed a higher degree of art-produce.

Two or three examples of this in prehistoric times have recently been adduced. Mr. H. Stopes reports in the Proceedings of the British Association for the Advancement of Science, 1890, a curious station in the Thames Valley, where some tribe in the Palæolithic condition had overwhelmed one with Neolithic culture; and not understanding the use of the polished stone implements of the latter had chipped them into rough stone shapes! Not less remarkable was the discovery of the brothers Siret, in the caves and rock-shelters near Almeria, Spain, that the most ancient Neolithic potteries there are distinctly superior in make and ornament to those of later date. Something similar seems to be the case with the interesting series of potteries lately exhumed in the Neolithic station of Latinne, Belgium, by M. de Puydt. They show a finish that we do not find in what appear to be later deposits.

Prehistoric Commerce Between Africa and Asia.

The ancient relations which existed between Egypt and the east coast of Africa on the one side, and Mesopotamia and India on the other, are placed in strong light by two articles which have lately appeared in the *Verhandlungen der Berliner Anthropologische Gesellschaft.*

The one, by G. Schweinfurth, undertakes to show the external relations of ancient Egypt by means of the origins of the earliest cultivated plants found in the tombs or mentioned in the inscriptions. Their three earliest and most valuable cereals, wheat, barley, and spelt, he believes were introduced from Babylonia. The fig was imported from southern Arabia, its native home. From Persia were brought the pomegranate and the henna used as a cosmetic by the beauties of the earliest dynasties. From the remoter region of India came rice, sorghum, sesame, and the sugar-cane. As all these exotic plants were familiar to the Egyptians at the beginning of their history, they testify to an active and far-reaching commerce before the date of Menes.

The second paper, by Mr. Merensky, is especially concerned with the culture influences of ancient India on eastern and central Africa. He adduces much historical evidence to illustrate this intercourse, and finds as the result of it the presence of Indian coral and pearls in central Africa, the shape of the hand axe, the musical instrument called the marimba, the use of the betel nut, the worship of fire, traces of a caste system, etc.

Both articles confirm the growing belief in the wide extension of prehistoric commerce.

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.*

On request in advance, one hundred copies of the number containing his communication will be furnished free to any correspondent.

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

The Question of the Celts.

IN "Current Notes on Anthropology" (*Science*, Mar. 11) Dr. Brinton reviews a late essay by Schaaffhausen upon the ethnographic position of the Celts. He states: "The difficult problem of the conflicting physical types among the Celtic nations — the one short in stature, brachycephalic, and brown, the other tall, dolichocephalic, and blond — he [Schaaffhausen] summarily solves by supposing either an intermixture with other types or a change in mode of life and climatic environment."

The first mentioned type is apparently that now represented by the Auvergnats and Savoyards, whose ancestors were the Celts of Cæsar. Now Schrader has pretty well established the fact that this race has no claim to the name Celtic other than the fact that at one time they spoke a Celtic dialect. Rather they were Ligurians related socially to the Lapps and Finns; and their original language was that now represented by Basque, their Celtic dialect having been acquired from the tall, fair, brachycephalic race which conquered them, and drove them to the south of France. There should be no need to say that community of language does not necessarily imply identity of race; for one only has to look upon the Mexicans, who speak a Neo-Latin dialect, but whose race type has almost wholly reverted to that of the Aztecs. The French inhabitants of Louisiana cannot now be distinguished by their language, and the speech of Jamaica is an English jargon, though the population is now almost wholly negro. The fact that French is a Neo-Latin language by no means proves any racial connection between the Latins and the French, who are descended from several distinct races.

Now there is very good evidence that the tall, fair, brachycephalic people, whose remains are found in the round barrows of Britain and in the graves of Belgium, France, and Denmark, spoke the original Celtic tongue. They were the Belgic Gauls, and they overran France, conquering the short, dark, brachycephalic Ligurians and imposing their language upon them. The Ligurian tongue, ancestral to Basque, was a Euskarian dialect related to the Ural-Altaic group, which was ill-fitted to survive in contact with the Aryan speech of the northern race. The best modern representatives of the type of the conquering race are the Danes and Slavs, especially the Lithuanians.

The tall, dolichocephalic and blond type is certainly represented now by the Swedes, and fair north Germans, and has been well called the Scandinavian type. The Anglo-Saxons and Teutonic tribes belonged to this race, and their speech was ancestral to the German and English. If this be true, and the facts seem well attested, it is hard to see how this tall, fair, dolichocephalic type can be logically drawn into the Celtic controversy.

In conclusion, it would seem that the conflicting types among the Celtic nations are due solely to the application of the name Celtic to several distinct races, and if that name is restricted, as there is excellent ground for doing, to the tall, fair, brachycephalic race, the difficulty of conflicting types vanishes.

P. MAX FOSHAY.

Rochester, March 15.

The Color Question Again.

I NOTICE in your issue of Feb. 26 an article by Professor Pillsbury of Smith College, in which my name is mentioned in connection with a system of color instruction.

Perhaps an explanation of the exact scope and intention of this scheme may avoid any misapprehension of the claims that are made for it.

The sole object has been to apply, as far as possible, scientific facts of color to elementary instruction in color and the artistic use of color. While it is easy to find various indications that the old theory of Brewster has been abandoned by the scientists and the Young-Helmholtz theory of the three primaries, red, green, and violet, accepted in its place, no practical advance in the application of the latter theory to art instruction has been secured. The following quotation from the publishers' notice of a valuable book, "Theory of Color," by Dr. Wilhelm von Bezold, shows the advanced ground regarding color taken by this scientist: —

"The theory of three primary colors, red, yellow, and blue, has therefore been abandoned, and with them the whole system of so-called secondary and tertiary colors has fallen to the ground. It might be feared that anarchy would take the place of order in the realm of color after the overthrow of the old system of classification. This is not the case, however, for the system of colors adopted by Professor von Bezold not only affords a ready means of classifying every sensation of color which may possibly affect the eye, but is exceedingly simple."

But experience has shown that this book, although the ablest attempt to unite the scientific theory of color with the practical use of colors ever offered at the time it was published, has, in the sixteen years since the English translation was printed, had no practical effect on the terms employed by the artists or on the methods employed in color instruction.

Owing to the fact that the illumination and purity of all pigmentary colors fall so far below the spectrum colors as found in sunlight, it it impossible with them to produce by the union of the three primaries, red, green, and violet, any reasonable approximation to the colors seen in nature. Therefore it has been practically impossible for artists and art educators to avail themselves of the scientific theories of color in their work.

Right here is where we find the real value of the system to which Professor Pillsbury has alluded. It practically bridges the chasm between the science of color and the practice of color in the use of pigments. Instead of beginning with three primary colors seen in the spectrum we are content to select six. By choosing six colors, red, orange, yellow, green, blue, and violet, as they appear in the spectrum, making the best imitations of them possible with pigments, and applying these to the Maxwell rotating disks, with the addition of black and white, we can make and accurately name a very large proportion of all the colors found in nature which also agree somewhat nearly with similar pigmentary compositions.

As above stated, this system of color instruction includes a practical nomenclature of color never before advanced, which has already been explained by Professor Pillsbury. Professor A. H. Church of the Royal Academy of Arts, in a series of lectures before the Society of Arts, London, an account of which has been published in this country, urges a scientific consideration of color in its application to art, and near the close of one of his lectures he says:—

"We want an international color conference, in which artists, manufacturers, and scientists shall be represented. We want an agreement upon the name to be assigned to a number of different hues. We want representations of these hues reproduced in enamel, preserved like our standards of weights and measures, and distributed to every educational institution in the United Kingdom. . . . The importance of having a definite nomenclature of quite intelligible character at our disposal when we are talking or writing about the decorative employment of color is so important that I venture to make a few suggestions which may tend toward the attainment of this object."

After making a suggestion for a method of notation, Professor Church adds: —

"The corresponding modifications in the five other principal series of colors would be expressed in a similar manner, the symbols, etc., being used exactly in the same way as in chemical notation. In order to obtain a scale in a concrete form I would recommend the use of Maxwell's rotation method by which each step in the gradation could be matched."

This author next proceeds to give a nomenclature of colors, but as it is based on the three primary colors of the scientist, namely, red, green, and violet, and the introduction with them of such additional terms as sea-green for a symbol, it is neither as simple nor as definite as the one which has been described in your article to which I have referred. This nomenclature is based solely on nature's standards as found in the solar spectrum. Should we be favored with the international conference suggested by Professor Church, and should such a conference adopt the six standards and definitely locate them in the spectrum by their wave lengths, the world would then have standards which are the same in one country as in another, and would remain the same in the twentieth century as in the nineteenth.

As a manufacturer of an extended line of colored papers I am constantly putting this proposed nomenclature to a severe test by ordering new colors by telephone. That is to say, we make the desired combinations on the wheel in our office and then telephone them to the factory, ten miles distant, where they are again made on the wheel and the papers are then manufactured to correspond with the results of these combinations. Under this plan we are liable to have occasion to "telephone a color" frequently. In the same way we could cable colors to Europe should it be necessary. MILTON BRADLEY.

Springfield, Mass., March 17.

Professor Alexander Agassiz on the Origin of the Fauna and Flora of the Galapagos Islands.

IN the "General Sketch of the Expedition of the 'Albatross' from February to May, 1891" (Bull. Mus. Comp., Zool., Harvard College, Vol. xxiii., No. 1, Cambridge, Feb., 1892) Professor Alexander Agassiz refers to my paper "On the Origin of the Galapagos Islands" (*Am. Nat.*, March–April, 1891). There are some fundamental misunderstandings of my statements in Professor Agassiz's remarks, which need correction.

Page 71, he says: "He [Baur] speaks of the Galapagos as being connected with the mainland by the 4,000-meter line." Then he adds "This [the connection of the Galapagos with South America] is an important fact; all the older maps showed the Galapagos separated from Central America" (!). To this I have to reply, that I never expressed the opinion that the Galapagos were formerly connected with South America. The same is repeated by Professor Agassiz in two other passages (p. 71).

In all my statements in regard to the land connections I was very cautious, as will be seen from p. 310: "*In their general characters the fuana and flora of the Galapagos show resemblances to the great Mexican and Sonoran province, and also to the West Indies, and it may be that the connection was with these regions (and it seems more probable than any other), but of course it is quite impossible to bring to-day any positive proof for this idea.*" (The italics are mine.)

According to Professor Agassiz the proof of my subsidence theory "is based on no better evidence than the so-called alpine character of parts of the flora and upon the presumed former connection of the Galapagos Islands with the Central American continent." Professor Agassiz has completely overlooked the main point of my argument. This I considered the harmony in the distribution of fauna and flora, as will be seen by referring to my paper. I tried to show that this harmony was absolutely unexplainable by the theory of elevation. After this was done, I examined whether our present knowledge of the soundings showed any serious obstacle to the theory of subsidence, and I found that it did not. *Professor Agassiz did not refer with one word to this harmony of distribution, which formed the basis of my whole ideas!*

When Professor Agassiz or any one else is able to explain this by the elevation theory, I shall be the first one to adopt it. But until this has been done, I believe in subsidence.

The paper to which Professor Agassiz refers was written before my visit to the islands. My investigations have only more convinced me of the insufficiency of the elevation theory. In my final work I shall speak fully about this question and about other points in Professor Agassiz's article. G. BAUR.

Clark University, Worcester, Mass., March 15.

The Scientific Alliance.

I HEARTILY agree with your leading article of March 11, and trust that you will continue to press this subject. The further co-operation of the scientific societies in this city will result, I feel confident, in increased activity and effectiveness in each.

The special needs of many branches of work now being carried on here are more funds for publication and for first-class illustration. There is no national publication open to all papers of merit, like the Royal Society Transactions. The only journal I know of which provides liberally for illustration is Whitman and Allis's *Journal of Morphology*, and this is now, I have learned, overstocked for two years to come with biological papers of a high class. HENRY F. OSBORN.

Biol. Dept., Columbia College, March 18.

BOOK-REVIEWS.

Travels amongst the Great Andes of the Equator. By EDWARD WHYMPER. New York, Scribner's. 8°. $6.

AMONG the fascinating books of Professor Tyndall's is one on "Hours of Exercise in the Alps," in which, among other matter, he records the several unsuccessful attempts he made to ascend the Matterhorn, and how the rope left, by his party, hanging over a ridge of rocks enabled the next following party of climbers headed by Edward Whymper to gain such advantage as to be able to reach the top. This first success was marred by a terrible tragedy, only three or four of the party of seven getting back to the foot of the mountain alive.

But Edward Whymper added another triumph to his record as a mountain climber in his being the first to reach the summit of Chimborazo in 1879. It is the account of his journey at that time that is now published.

A hundred years ago the natives of the valley of Chamonix who took travellers up the mountain suffered as much as their employers from physical sensations ascribed, no doubt rightly, to the rarity of the air. They were unable to walk more than a few paces without halting. Last autumn travellers who walked in early morning from the hut under the Bosses (14,000 feet) to the top (15,780 feet) had the company of five Chamoniards. They went up at a fair pace without resting. Arrived on the top, without a moment's pause, the men took their spades and shovels and began digging. They asserted that they did only about a third less work in the day than in the valley; and that they suffered no inconvenience from a prolonged stay in the Bosses hut; slept well, and ate largely. Their work was to excavate a tunnel in the summit ridge about thirty feet below the top. The object of this tunnel was to reach rock, in which a shelter-cave might be excavated.

Mountain-sickness is a term which has been used during the nineteenth century to designate the ailments which come to men and beasts on reaching high elevations on mountains. Some supposed that the uncomfortable symptoms were the result of local causes, and did not depend solely on reduced atmospheric pressures, as is the opinion of Mr. Whymper.

It was largely with a view to settle various questions in regard to mountain-sickness that the journey to the Andes was undertaken. Mr. Whymper wished to learn: (1) at what pressure the symptoms would first appear; (2) what form the sickness would take; (3) whether one could become habituated to low pressures.

To the first question the answer came at a pressure of 16.5 inches. Most of the party were simultaneously incapacitated for work and found themselves preoccupied by the paramount necessity of obtaining air. Precautions had been taken not to introduce complications in the way of physical exhaustion, Mr. Whymper maintaining "that our 'incapacity' was due neither to exhaustion nor to deficiency of bodily strength, nor to weakness from want of food, but was caused by the whole of our attention being taken up in efforts to get air." This gasping for air was accompanied with intense headache and an indescribable feeling of illness, pervading the whole body. The attack was sudden, but the recovery gradual; and even at the best it was only while at rest that sufficient air could be secured through the nostrils; on exerting themselves it was necessary to breathe through the mouth as well, and the capacity for work was low.

In reviewing the whole of their experiences, two different sets of effects could be distinguished: those which were transitory, and those which remained so long as the party was exposed to low pressures. The transitory effects were acceleration of the circulation, and increase in temperature. The permanent ones were more rapid respiration, indisposition to take food, and lessening of muscular power.

In the opinion of Mr. Whymper, the mountain-sickness is due to diminished atmospheric pressure, which operates in two ways: by lessening the value of the air inhaled, and by allowing the gases within the body to expand and seek partial escape.

But aside from the value of the book as a record of investigation on mountain-sickness, which is, by the way, made by no means prominent, we have in "Travels amongst the Great Andes of the Equator" a most valuable record of travel, well written.

A "Supplementary Appendix," to which some fifteen prominent naturalists contribute, is devoted to the collections made in the Andes, a very considerable part being on the coleoptera. The ample number of plates and illustrations make the whole work one of special value as a scientific record, and the account of the journey is most entertaining.

Order in the Physical World and its First Cause According to Modern Science. From the French. New York, James Pott & Co. 12°. $1.

Natural Law in the Spiritual World. By HENRY DRUMMOND. New York, James Pott & Co. 12°. 75 cts.

THESE two works are eminently characteristic of the present time. The relations between science and religion have been the constant theme of comment and controversy for the past thirty years, and still excite extraordinary interest in certain classes of minds. Persons of an atheistical turn point to certain discoveries and theories of science as negativing the very idea of religion; defenders of Christianity repel the charge; while a third class of writers endeavor to reconcile the two conflicting systems of thought by finding some rational ground of agreement. The two works now before us belong to this last category. The first, which is translated from an anonymous French writer, is an adaptation of the design argument to the present state of scientific knowledge; the discoveries of science themselves furnishing the basis on which the argument rests. It is not a profound work nor in any way original; and it will not satisfy minds thoroughly imbued with the skepticism so characteristic of the present time. But for those who think the design argument a convincing one the book will have an interest. Unfortunately the English of the translation is imperfect and sometimes ungrammatical, especially in the earlier pages, and typographical blunders, such as "sideral" for sidereal, "Emmerson" for Emerson, etc., are altogether too frequent.

The second volume before us is of a different character, and somewhat curious. The author, Mr. Drummond, as he tells us in his preface, had been employed for some years in teaching the natural sciences on week days and lecturing upon religious themes on Sundays. Naturally, and almost necessarily, he was led to a study of the relations between the two subjects and to seek some basis of agreement between them. The result appears in this book, in which he endeavors to show that the laws of biology, which are manifest in organic life, are no less manifest in religious, or, as he calls it, spiritual life. Analogies between organic life and the mental and moral life of man have often been pointed out before; but Mr. Drummond maintains there is something more than analogy in the case, that the very same laws operate in these widely different spheres. We cannot think, however, that he proves his thesis, the resemblances that he points out between the natural and the spiritual world being, in spite of his disclaimer, nothing but mere analogies, and often remote and fanciful analogies. For instance, he speaks of the law of biogenesis, that life can only come from antecedent life, and argues that this is the same as the Christian doctrine that a man must "be born of water and of the spirit" in order to enter the Kingdom of God. He even speaks of "spiritual protoplasm," and declares that the difference between a Christian and a good man who is not a Christian is the difference between the living and the dead. As poetic analogies between natural and spiritual things, some of the resemblances that Mr. Drummond dilates upon have a certain interest, and serve well to illustrate moral and religious truth; but as the basis of scientific doctrine and as proving the reign of law in the spiritual world, they are of little value.

AMONG THE PUBLISHERS.

THE exclusive authorization to issue an English translation of the "Memoirs of the Baron de Marbot," which have created unusual interest in Paris, has been acquired from the Baron's representatives by Longmans, Green, & Co. They will publish the work immediately, both in New York and London.

— P. Blakiston, Son, & Co. have brought out a second edition of Blair's "The Organic Analysis of Potable Waters." Considering that the first edition was published but little over a year ago, this shows that the book has proved a good one.

— Messrs. Eason & Son, Dublin, will issue in April the first number of the *Irish Naturalist*, a monthly journal of general Irish natural history, and the official organ of all the natural history Societies in Ireland. The editors will be Mr. George H. Carpenter and Mr. R. Lloyd Praeger.

— A new *Physical Review* has been started by the publisher, J. Engelhorn, of Stuttgart. The editor is L. Graetz. The object of this periodical will be to make German readers acquainted with the work being done by physicists in other countries. It is intended that it shall serve as a sort of supplement to the well-known *Annalen der Physik und Chemie*.

— W. B. Saunders, 913 Walnut Street, Philadelphia, has published, as No. 22 of Saunders's Question Compends, "Essentials of Physics," by Fred. J. Brockway, M.D. The book is arranged in the form of questions and answers prepared especially for students of medicine. The author is assistant demonstrator of anatomy at the College of Physicians and Surgeons, New York. The reasons assigned for the existence of the book are that Ganot is too large for the purposes of medical students and that some of the other text-books do not contain enough.

— *Natural Science* is a new monthly review of natural history progress. The object of the editors will be "to expound and deal in a critical manner with the principal results of current research in geology and biology that appear to be of more than limited application." Articles are contributed to the first number by Mr. F. E. Beddard, Mr. J. J. H. Teall, F.R.S., Mr. A. S. Woodward, Mr. R. Lydekker, Mr. J. W. Davis, Mr. G. A. Boulenger, Mr. J. W. Gregory, Mr. G. H. Carpenter, and Mr. Thomas Hick. The publishers are Messrs. Macmillan & Co.

— Every teacher of physics will be glad to know that a tenth edition of Maxwell's "Theory of Heat" has just been issued by Longmans, Green, & Co. Lord Rayleigh is the editor, which is sufficient to make all physicists confident that the necessary revision has been well done. It is probable that no more suggestive work was ever produced in the whole science of physics. It is more than its name signifies, for a number of physical problems are discussed, which are not usually treated under the head of "heat." But no one should take up the book unless he is prepared for some pretty intense study. It is not a popular work, but for those competent to understand even portions of it it stands without any equal as a guide to the study of physical science.

— "A Guide to the Scientific Examination of Soils: Comprising Select Methods of Mechanical and Chemical Analysis and Physical Investigation" is the title of a book recently published by Henry Carey Baird & Co., Philadelphia, at $1.50. It is a translation from the German of Dr. Felix Wahnschaffe, with additions, by William T. Brannt. Mr. Brannt is editor of "The Technochemical Receipt Book." The "Guide to the Scientific Examination of Soils" is a book for the agricultural chemist. There are introductory chapters on "Derivation and Formation of the Soil," and "Classification of Soils"; but these are brief, and the main purpose of the work is shown in the chapters bearing more directly on methods, mechanical and chemical, to be used in determining the soil-constituents and their plant-nourishing value. This last depends, as is well known on more than mere chemical constitution, and due attention is given to the determination of the properties of the soil depending on physical as well as chemical causes.

— The name of nearly every appliance on the English railway is different from the corresponding term applied on the American railroad, yet many of the problems involved in the working of rail transportation are the same. Only three or four years ago a lecture on "The Working of an English Railway" was delivered before the School for Military Engineering at Brompton Barracks, England, by George Findlay, who, in addition to holding certain rank in the volunteer service of England, is general manager of the London and Northwestern railway. This lecture was naturally devoted, to some extent at least, to the use of railways in military operations. It proved attractive, however, to a wider circle of readers than the army officers to whom it was first delivered, and the result was the first edition of "The Working and Management of an English Railway." Additions to the scope of the original lecture were made to adapt it to its new public, with the result that we now have before us the fourth edition, published in this country by Macmillan & Co. The subjects treated range all the way from such as are purely mechanical—the permanent way, rolling stock, signals, telegraphs, etc.—to questions concerning the relation of the state to railways and the state purchase of railways, which are to some extent social. There are some imperfections in the mechanical execution of the book, perhaps due to the large number of copies printed, but it is sure to interest all who want a popular *exposé* of the ways in which the modern railway has been brought into existence and the problems occupying the minds of those now managing them.

—Fleming H. Revell Company, New York, are the American publishers of "Heroes of the Telegraph" ($1.40), by J. Munro, which is brought out in England by The Religious Tract Society. Mr. Munro has written a number of popular books on electricity and the lives of workers in this comparatively new science. As an Englishman, he gives first place to Sir Charles Wheatstone among the heroes of the telegraph, and no one will wish to withhold any of the honors due that great pioneer in electrical science, especially as the author, in his second chapter devoted to S. B. F. Morse, does full justice to him whom we Americans are proud to consider as the inventor *par excellence* of the telegraph. But it is not with him that work on the telegraph ceased. Much work remained to be done before sub-marine cables and long and complicated land-lines were a possibility, and so there are chapters containing interesting accounts of the contributions to the telegraph made by Sir Wm. Thomson, Sir Wm. Siemens, Fleeming Jenkin, Reis, Bell, Edison, Hughes, Gauss, Weber, Sir W. F. Cooke, Bain, Dr. Werner Siemens, Latimer Clark, Count du Moncel, and Elisha Gray.

— So many ask for a really good elementary book in electricity and magnetism that we are inclined to hope much usefulness for "A First book of Electricity and Magnetism" (60 cents), by W. Perren Maycock, recently brought out by Macmillan & Co., on this side of the water. The book is an English one, the author being a member of the English Institute of Electrical Engineers. The author does not touch upon the modern electrical theories, which are attracting so much attention, but which would be extremely unpromising subjects for popular exposition as they now stand; but he certainly seems to give a clear statement of the facts of electrical science in a way likely to be helpful to many who have not the training to use such excellent books as those by Silvanus Thompson or Fleeming Jenkin.

— Another book intended to serve the same purpose as that mentioned above has been published by Norman W. Henley & Co., New York, entitled "Electricity Simplified," by T. O'Sloane. The author of this book has met with success as a writer of primers on scientific subjects, his "Home Experiments in Science" and "The Arithmetic of Electricity" being doubtless known to many of our readers. There is certainly a demand for an elementary book that will tell the uninitiated something of the wonders of electricity, and all seeking such information should examine Sloane's "Electricity Simplified." ($1.).

— A notable literary article will appear in the April *Forum* by Mr. Philip G. Hamerton, who discusses the important subject of the Learning of Languages. Mr. Hamerton is one of the few men who are absolutely as much at home in French as in English, and his experience and observation make his article full of suggestiveness. The historian, Professor Edward A. Freeman, writes an autobiographical essay showing the growth of his opinions and method of work. Mr. R. L. Garner, the student of the speech of monkeys, contributes the most interesting paper that he has yet published on the results of his investigations. Other articles in this number will be on the German Emperor's policy of removing restrictions upon trade, by Mr. Poultney Bigelow, his personal friend; on German Colonization and Emigration, by Dr. Geffcken; an explanation of the method of burial by the great funeral monopoly in Paris, by Mr. Edmund R. Spearman, who has made a special study of it for the *Forum*.

— "Age of the Domestic Animals" is a treatise on the dentition of the horse, ox, sheep, hog, and dog, and on the various other means of determining the age of these animals, by Rush Shippen Huidekoper, M.D., veterinarian (Alfort, France); professor of sanitary medicine and veterinary jurisprudence, American Veterinary College, New York. This work presents a study of all that has been written on the subject from the earliest Italian writers. The author has drawn much material from the ablest English, French, and German writers, and has given his own deductions and opinions, whether they agree or disagree with such investigators as Bracy Clark, Simonds (in English), Girard, Chauveau, Leyh, Le Coque, Goubaux, and Barrier (in German and French). The illustrations have been mainly taken from these authors, and it would be extremely difficult to improve upon them. There are, however, a large number of original illustrations on the horse, cattle, sheep, and pig. To quote from the preface, "The author has attempted to prepare such a book as he feels would have been of interest and service to himself in his association with animals as a layman, and would have aided his studies and appreciation of the anatomy of the teeth, dentition, and means of determining the age. He hopes, also, that this work will furnish, to students and veterinarians, knowledge which will aid in surgical operations on the mouth." The publishers are, F. A. Davis & Co., 1231 Filbert Street, Philadelphia.

— Macmillan & Co. will issue early in April an important work by Professor J. Henry Middleton on the "Remains of Ancient Rome," comprising two fully illustrated volumes.

— Messrs. Gauthier-Villars have published a work entitled "Leçons de Chimie," by Henri Gautier and Georges Charpy. It is intended mainly for the use of students of special mathematics.

— Professor Geo. J. Romanes has arranged with the Open Court Publishing Co. to bring out the American edition of his latest work, "Darwin and after Darwin." It will be published simultaneously with the English edition.

— Mashonaland, in south Africa (called "the future gold-fields of the world"), will be described in the April *Scribner* by Frank Mandy, a member of the Pioneer Corps which opened up the country for settlers. He has spent many years in that region, and is an acknowledged authority upon it.

— An excellent series of "Museum Hand-Books" is being issued by the Manchester Museum, Owens College. A "General Guide to the Contents of the Museum" has been prepared by Mr. W. E. Hoyle, keeper of the Museum. and Professor Milnes Marshall has drawn up an "Outline Classification of the Animal Kingdom," and a "Descriptive Catalogue of the Embryological Models."

— We learn from *Nature* that the first part will shortly be issued by Messrs. Dulau & Co. of a new botanical publication, to be called British Museum Phycological Memoirs, edited by Mr. George Murray. It will be devoted exclusively to original algological papers, the records of research carried on in the Cryptogamic laboratory of the British Museum in Cromwell Road, and is intended to be issued at about half-yearly intervals. The first part will be illustrated by eight plates, and will contain, among other articles, the description of a new order of Marine Algæ.

— There is evidently, in the opinion of one man at least, a perfect climate in one portion of the United States. The man is P. C. Remondino, M.D., and the place is Southern California. The beauties of Southern California Dr. Remondino sets forth in "The Mediterranean Shores of America," just published by F. A. Davis & Co., Philadelphia. After speaking of the beautiful adjustment of humidity to temperature, so that hot, muggy days are unknown, our author goes on to tell of the calm character of the weather, which is such that thunder-storms are almost unknown, and the signal office at San Diego, after eight years' waiting, found the storm flags of no use and returned them to Washington. Southern California, our author maintains, has as varied a climate as that of the north of Italy, or even more extremes of condition, but, with these extremes, enjoys the anomalous condition of having these extremes alike favorable to health and long life — just the reverse of northern Italy. The book is, of course, intended to convey such information as those seeking a health resort desire.

— The American Academy of Political and Social Science, with headquarters at Philadelphia, announce for early publication the following monographs on political and economic subjects: "Ethical Training in the Public Schools," by Charles DeGarmo, president of Swarthmore College, an essay which is intended to prove the necessity of moral instruction in our public schools, but to show that it need not necessarily be religious; "The Theory of Value," by the Austrian economist, F. von Wieser, a scientific explanation of the views of the Austrian school on this subject; "Basis of Interest," by Dwight M. Lowrey, a reply to Henry George's doctrines on this question. They will also publish at an early date a monograph on "Party Government," by Charles Richardson, which is a severe attack on the theory that devotion to party is a political virtue; and a pamphlet by J. R. Commons of Oberlin College on "Proportional Representation," in which a plan is disclosed which will prevent gerrymandering and secure minority representation.

— "The Will Power: its Range in Action," by J. Milner Fothergill, is a small book published by James Pott & Co. It is not a metaphysical essay, but a practical work on the importance in human life of strength of will, which the author regards as the principal thing in man's character and the main source of one man's influence over others. The different aspects of the subject, such as the will in relation to heredity, the will and circumstances, etc., are treated of, and some interesting anecdotes related to illustrate the author's doctrine. From the doctrine itself, however, we are obliged to dissent, because it puts strength of will above rightness of will, force above virtue. The highest principle in man is not will but conscience; conscience is the lawgiver, while the will's business is to obey, but Mr. Fothergill shows no sufficient appreciation of this fact. He admits, indeed, that strength of will may be used for evil as well as for good, and in many of the examples he adduces what he calls strength of will is merely selfishness or a domineering temper. Yet he expressly says: "Mighty as the will is, the first numeral in character, the next is principle in this world; in the next world, we are told, principle will come first" (p. 181). Such a doctrine, if carried into practice, would lead directly to immoral conduct; and we cannot, therefore, recommend this book as a means of moral instruction.

— The American Academy of Political and Social Science has just published a monograph by Leo S. Rowe on "Instruction in French Universities." This is the fifth of the monographs which they have issued treating of instruction in political science, etc., in various countries. Of the other four, two treated of German universities, one of the University of Oxford, and one of Italian universities. They also published a pamphlet on Jurisprudence in American Universities. The present essay gives a careful exposition of the system of faculties in vogue in France, together with a brief history of the higher educational system from the time of Napoleon to the present. It also explains the new system of universities which is now being advocated. Mr. Rowe then discusses the courses in political science, etc., which are offered by the law faculties and the other institutions, such as the École Libre and the Collège de France. The monograph concludes with some very valuable university statistics and a complete list of the instructors in political science and public law in the various institutions of higher education in France.

— The latest issue in the "Contemporary Science Series," published in England by Walter Scott and imported here by Charles Scribner's Sons, is a work by Karl Pearson entitled "The Grammar of Science." It is a discussion of the scope and method of science and of some of its fundamental principles. The author sneers at metaphysics, declaring both metaphysics and natural theology to be pseudo-sciences; and yet his own book is metaphysical from beginning to end, only it is bad metaphysics. Mr. Pearson adopts the subjectivist, or "idealist" theory of knowledge, which denies the existence of a real material world and regards external objects as nothing but groups of sensations. He adopts Kant's theory of space and time, though he derides Kant for being a metaphysician. His view of causation is borrowed of Hume; and he maintains that the business of science is merely to describe facts, not to explain them. "Science," he says, "deals with the mental, the inside world," and a law of nature is not an order of external facts but merely a "routine of perceptions." He alludes to Newton's formula of gravitation, and then goes on to say: "The statement of this formula was not so much the discovery as the *creation* of the law of gravitation. A natural law is thus seen to be a *résumé* in mental shorthand, which replaces for us a lengthy description of the sequences among our sense-impressions. Law in the scientific sense is thus essentially a product of the human mind and has no meaning apart from man. It owes its existence to the creative power of his intellect There is more meaning in the statement that man gives laws to Nature than in its converse that Nature gives laws to man" (p. 104). Such is the burden of the whole book, and it is thrust forward on every possible occasion; and it shows, we think, with sufficient clearness the mental calibre of the author and the quality of his book.

— The first number of the new *Zeitschrift für Anorganische Chemie*, edited by Professor Krüss, of Munich, was issued on Feb. 27. As its title implies, the new journal is devoted exclusively to the inorganic branch of chemistry, and the names of the distinguished chemists throughout Europe and America whose co-operation the editor has been fortunate in securing would appear to promise well for its value and success. The first number, says *Nature*, contains the following six original memoirs: "Phosphorus Sulphoxide," by T. E. Thorpe and A. E. Tutton; "The Double Acids of Heptatomic Iodine," by C. W. Blomstrand; "The Action of Hydrogen Peroxide upon certain Fluorides," by A. Piccini; "Ammoniacal Platinum Compounds," by O. Carlgren and P. T. Cleve; "Preparation of Tungstates free from Molybdenum," by C. Friedheim and R. Meyer; "A Lecture Experiment," by C. Winkler.

— "Humanity in its Origin and Early Growth," by E. Colbert, is a work recently issued by the Open Court Publishing Company of Chicago. It is, of course, mainly historic in character, and much that it contains is familiar. The history of religion is the leading topic in it, but considerable space is also devoted to the origin and growth of language and the rise of the industrial arts. The book, however, is full of crude and often fantastic theories, the author being one of those men, by no means rare in these days, who have thrown off all traditional religious belief and taken an attitude of religious skepticism, but are, nevertheless, extremely credulous of new-fangled theories and alleged scientific discoveries. Thus Mr. Colbert tells us with an air of assured conviction that man originated at the North Pole, and also that some thousands of years hence most of the land in the northern hemisphere will be submerged by the ocean, while a vast southern continent will arise from the waters. Religion, he thinks, originated in the worship of the heavenly bodies; and expressly says that the Greek and Roman Jupiter is nothing else than the planet of that name (p. 230). He thinks that religion was mainly the work of the priests, who used the popular belief in astrology and magic as a means of domineering over men; and he nowhere shows any conception of the grandeur of the religious sentiment nor any respect for the religious beliefs of mankind. Yet he is half inclined to believe in astrology himself, holding that "a great deal may be said in justification of the old fashioned idea of stellar and planetary rule over the affairs of men" (p. 390). Altogether the book is a curious one, especially as revealing the character of the author's own mind.

— Houghton, Mifflin & Co., have recently issued a large-paper edition (of 250 copies) of "The Discovery of America," by John Fiske, a work in four volumes, forming the beginning of Mr. Fiske's history of America, and the most important single portion yet completed, written upon original sources of information regarding ancient America, the Spanish conquest, mediæval trade, questions about Columbus, the causes of the transfer of supremacy from the Spanish race to the English, etc. The work contains abundant foot-notes, which are the results of vast research. We understand that the whole of this large-paper edition has al-

CALENDAR OF SOCIETIES.

Chemical Society, Washington.

Mar. 10. — H. W. Wiley and Wm. H. Krug, The Solubility of some Inorganic Salts in Acetone and of Acetone in Dextrose Solutions; H. W. Wiley and K. P. McElroy, The Specific Gravity of Acetone and Mixtures of Acetone and Water.

Publications received at Editor's Office.

DRUMMOND, HENRY. Natural Law in the Spiritual World. New York, James Pott & Co. 12°. 438 p. 75 cts.

FOTHERGILL, J. MILNER. The Will Power; its Range in Action. 3d. ed. New York, James Pott & Co. 12°. 184 p. 60 cts.

MAXWELL, J. CLERK. Theory of Heat. 10th ed. New York, Longmans, Green & Co. 16°. 357 p. $1.50

MEYER, LOTHAR. Outlines of Theoretical Chemistry. Trans. by D. Phillips Bedson and W. Carleton Williams. New York, Longmans, Green & Co. 8°. 232 p. $2.50.

ORDER in the Physical World, and its First Cause according to Modern Science. From the French. New York, James Pott & Co. 12°. 247 p. $1.

PEARSON, KARL. The Grammar of Science. London, Walter Scott. New York, imported by Charles Scribner's Sons. 12°. 510 p. $1.25.

TILLMAN, S. E. Elementary Lessons in Heat. 2d ed., revised and enlarged. New York, John Wiley & Sons. 8°. 172 p.

WHITELEY, J. LLOYD. Chemical Calculations. New York, Longmans, Green & Co. 12°. 114 p. 60 cts.

WORTHINGTON, A. M. Dynamics of Rotation. New York, Longmans, Green & Co. 12°. 167 p. $1.

Exchanges.

[Free of charge to all, if of satisfactory character. Address N. D. C. Hodges, 874 Broadway, New York.]

For sale or exchange, Das Ausland, 10 vols., 1882 to 1891, including 6 vols. bound, 4 in numbers. Wheeler Survey, vol. 1, Geog. Report; also vol. 6, Botany; Production of gold and silver in the United States, 1880, '1, '2, '3, '5; Selfridge Isthmus of Darien. Will sell at very low prices. J. F. James, 1443 Corcoran St., Washington, D. C.

For exchange.—A fine thirteen-keyed flute in leather covered case, for a photograph camera suitable for making lantern slides. Flute cost $27, and is nearly new. U. O. COX, Mankato, Minn.

Wants.

Any person seeking a position for which he is qualified by his scientific attainments, or any person seeking some one to fill a position of this character, be it that of a teacher of science, chemist, draughtsman, or what not, can have the 'Want' inserted under this head at 10 cents a count line. Nothing inserted at less than 50 cents a time prepaid by stamps, if most convenient.

TRANSLATOR wanted to read German architectural works at sight (no writing). One familiar with technical terms desired. Address "A.," Box 149, New York Post Office.

WANTED.—A position in a manufacturing establishment by a manufacturing Chemist of inventive ability. Address M. W. B , care of *Science*, 874 Broadway, N. Y.

WANTED.—Books on Anatomy and Hypnotism. Will pay cash or give similar books in exchange. Also want medical battery and photo outfit. DR. ANDERSON, 182 State street, Chicago, Ill.

WANTED.—A college graduate with some normal training, to teach the sciences, at $1,800 per year, in a Southern college. A Baptist or a Methodist preferred. Must also be a first-class Latin scholar. A. H. Beals, Box K, Milledgeville, Ga.

A PROFESSORSHIP in Chemistry is wanted by one who has had five years' experience in that capacity. Would prefer to give instruction by lectures and experiments rather than by text-book methods. Would like a position in a college or university where there is a good student's laboratory. Special points of strength claimed are: (1) Thorough control of a class and good order during lectures and recitations. (2) Accuracy in experimenting with chemicals and skill in the manipulation of chemical apparatus. The permission of several distinguished educators has been given to refer to them if required. Would not care to accept a position paying less than $1,500. Address B. E., care of *Science*, Advertising Dept., 47 Lafayette Place, New York.

ADDRESS WANTED.—Will some one please send the address of the Secretary of the American Philological Society. Also that of Herbert Spencer. "ADDISON," Room 84, 164 Madison St., Chicago, Ill.

ADDRESSES of Old Book Dealers wanted.—Wishing to obtain a number of old books out of print, I very much desire the addresses or catalogues of rare second-hand book dealers. If there is a directory or list of such dealers I should like to obtain possession of one. W. A. BLAKELY, Chicago, Ill.

WANTED.—(1) A white man versed in wood and iron working, able to work from specifications and plans, suited for an instructor of boys; his business to have charge of shops of school, outline and direct the work for foremen and students; salary to be $1,000 per annum (nine months). (2) A man (black preferred) to teach the colored, iron working and forging, subordinate to the preceding; salary, $720. (3) A man (white) competent to take classes in engineering (assistant's position), but with the ability to perform any of the work required in any of the ordinary engineering courses of our universities; salary from $1,000 to $1,500. A. H. BEALS, Milledgeville, Ga.

ready been sold. The regular edition, in two volumes, will be ready on the 26th.

— J. B. Lippincott Co., Philadelphia, recently issued "The Tannins," by Henry Trimble. The author is professor of analytical chemistry in the Philadelphia College of Pharmacy. It is now about one hundred years since tannin first became recognized as a distinct substance. About twelve years ago the author commenced to collect the literature of the subject, especially that referring to the astringent value of certain tannin-bearing materials, with the methods involved in their estimation. As is always the case with one thoroughly interested in his subject, the work grew on Professor Trimble's hands till he thought best to give to the public a work on the general subject, with gallotannic acid, and an index to the literature, leaving for a subsequent volume the remaining individual tannins. It has been the author's constant endeavor to make the book more than a mere compilation, and the results of much of his own experience have, therefore, been incorporated. It is the author's hope that the present publication may lead others to aid in bringing together information on his subject.

— The American Book Company, New York, Cincinnati, and Chicago, has recently issued a "Laboratory Manual of Chemistry," by James E. Armstrong and James H. Norton. Mr. Armstrong is principal of Lake High School, Chicago; and Mr. Norton is principal of Lake View High School of the same city. The purpose of the manual is to aid the student in his laboratory work in such experiments as he can conduct himself, the experimental work to be supplemented by a course in some good text-book. We do not recall any other manual for use in chemical work in school laboratories which at all compares with the one now before us, and it seems to show that the interest in the best methods of scientific training in schools is making great progress.

SCIENCE

A WEEKLY NEWSPAPER OF ALL THE ARTS AND SCIENCES.

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SCIENCE

NEW YORK, APRIL 1, 1892.

STORAGE OF STORM-WATERS ON THE GREAT PLAINS.

SOMEWHAT exaggerated expectations have been aroused by the speculations of certain theorists in regard to the possibilities of water storage on the high, wind-swept, treeless plains lying between the 98th meridian and the Rocky Mountains. These visionaries have virtually promised every farmer a reservoir on his land if he would only make the effort to secure it.

The need of storage, if it can be made a success, is indisputable. Rivers are few, and, as a rule, inadequate to the irrigation of more than the lands of their own valley. Artesian wells are limited to certain sharply defined basins. Other wells are generally too deep for profitable irrigation by pumping, except for small plats of fruit and garden vegetables. If the mesas are to be extensively irrigated it must be by storage of storm-waters. Can it be done? If there is any doubt about it we would better know the truth than to encourage delusive hopes. Let us seek some quantitative numerical expression for the possibilities and limitations of storage.

The great robber of moisture on the plains is evaporation. The activity of the winds is so great and constant that more vapor is raised from exposed water surfaces than in many regions of greater heat. The annual evaporation is seldom, if ever, less than four feet, and may rise to eight feet. We may safely put the average as high as five feet.

The rain fall varies from one to two feet. Its seasonal distribution is favorable, the late spring months and the summer months receiving the greatest amount. So far as the quantity and seasonal distribution of the rainfall are concerned the chances of impounding some of it look encouraging. But it is not so much the aggregate of precipitation as the percentage of it which flows off on the surface, which determines the feasibility of storage. In a treeless region of great evaporation and porous soil and subsoil, the total run-off is always low, and much of that is subterranean. Humphreys and Abbott, in their report on the Mississippi River, estimate the total run-off of the Missouri valley at 15 per cent of the rain fall. This includes the springs which feed the rivers, as well as the superficial run-off. This subterranean factor is unusually large on the plains, because there are large areas on the mesas and among the sand hills, which have no surface streams. All moisture reaching the rivers from these areas percolates beneath the surface, and the superficial run-off is by so much diminished.

Again, if the average for the whole Missouri valley is 15 per cent of the rain fall, it is less than that on the plains, because the whole basin includes wooded areas and steep mountain slopes, from both of which the run-off is more than the average. If we reckon 7.5 per cent as the superficial run-off of the plains, that will certainly be as favorable as the considerations just presented will possibly admit. It is more likely to be too high than too low, for fully half, if not more, of the run-off is subterranean, and the total is less than 15 per cent, while we have allowed half of 15 per cent for surface flow which may be impounded.

The third important consideration is seepage. A reservoir may be made absolutely water-tight, but it is not likely to be. Rather is it absolutely certain that for small storage on the farm, executed without the aid of professional engineering, and under rigid conditions of economy, so that cementing, or puddling with clay, is out of the question on account of the expense, the loss by seepage will always be considerable. The possible variations of such loss are so great that we can do no better than to make a somewhat arbitrary assumption of its amount, say two feet annually. If the site is so badly selected, and the dam so poorly built, that the water will be lowered more than two feet annually by percolation, success is improbable; on the other hand, less than two feet would be too small a margin to allow for seepage under the circumstances. More would be fatal, and less is improbable.

The fourth consideration is the ratio of catchment basin to reservoir surface. This factor is more under human control than the others. At first blush it might be thought to be wholly a matter of choice. And so it is if the reservoir is artificially excavated. It may be dug deep and narrow to prevent evaporation. Its surface may be made only one-millionth of the catchment basin, if that is desirable. But the economy of water storage for irrigation will not admit of more excavation than that required to procure earth for the dam. Aside from the cost of digging it, a deep pit would require a pump to raise the water. Natural depressions must be utilized. But these are always broad and shallow on the uplands. Deep cañons and valleys are excluded because they are below the lands to be irrigated. They may answer for the valley lands below them, but not for the table-lands which we are considering. In the wide shallow basins of the uplands, if the waters have any considerable depth, they will spread abroad, cover much good land, and lose much by evaporation. But they must have considerable average depth throughout the year for two reasons. The maximum depth will occur after storms, the minimum during periods of drought. Unless the average is high it may readily happen that little or no water is available just when the crops need irrigation. Furthermore, the depth should be considerable, or else the reservoir will flood nearly as much land as can be irrigated from it. E. S. Nettleton, chief engineer of the Irrigation survey, U. S. Dept. of Agriculture, estimates that an annual average of nine inches of water over the whole surface of the field will be required for successful irrigation on the plains. One acre of reservoir with an annual average depth of four and one-half feet will therefore irrigate six acres of land. The value of the flooded land will absorb the profits of the operation if the ratio is greater than that, that is, if the depth of water is less.

It is evident that when water is impounded in natural depressions on the table-lands the reservoir will necessarily cover a considerable fraction of its catchment basin. Take the proposition that every farm may have a reservoir, and see how it will figure out. For an average annual depth of four or five feet the water will spread over several acres, certainly not less than five acres. On a farm of 160 acres the catchment basin cannot be more than 32 times as large as the reservoir. Drawing from the lands of one's neighbors cannot be counted upon. Your neighbor below will be as likely to draw from your land as you are to draw from your neighbor above. The chances are even, and, in the general summing up of catchment areas, each can only count upon his own. Indeed he cannot count upon all of his own land, for, if it is all devoted to gathering and storing the water, where is the field to be irrigated ? That must lie below the reservoir, as the catchment basin must lie above it. This simple matter of levels imposes another rigid limitation upon successful storage. Tillage of the catchment basin, causing greater absorption of the rainfall — possibly complete absorption of it — is another contingency which may defeat storage.

If the farmer owns a half section, 328 acres, and if we make due allowance for irrigated fields, and for slopes which face away from the reservoir, he may possibly get a ratio as high as 50:1. This is not enough for successful storage. On a section, 640 acres, it might be as high as 100:1, if the slopes were happily disposed. Instead, therefore, of a possible reservoir on every farm, it is clear that only very large farms having a favorable topography can enjoy this luxury. The ratio 100:1 probably represents the maximum of favorable conditions which can ordinarily be realized on the plains. Hence we need not consider the possible results of any higher ratio. Nor need we go below the ratio 50:1, since that is already below the requirements of successful storage.

It appears then that, instead of the ratio of catchment to the storage area being a matter of choice, it is subject to quite narrow limitations.

We set out to seek quantitative results. By using data given above for evaporation, run-off, and seepage, which are believed to be fairly good approximations to the actual values of those factors, we may construct[1] the following table: —

Table showing the annual average depth of water for ratios varying from 50:1 to 100:1, and for rainfall varying from one to two feet, the annual evaporation being five feet, seepage two feet, and the run-off 7.5 per cent.

Ratio of Catchment to Reservoir Surface.	Depth of Water for a Rainfall of				
	12 inches.	15 inches.	18 inches.	21 inches.	24 inches.
50:1	None.	None.	None.	None.	.5 ft.
60:1	"	"	"	.87 ft.	2. ft.
70:1	"	"	.87 ft.	2.19 ft.	3.5 ft.
80:1	"	.5 ft.	2. ft.	3.5 ft.	5. ft.
90:1	"	1.44 ft.	3.12 ft.	4.81 ft.	6.5 ft.
100:1	.5 ft.	2.37 ft.	4.25 ft.	6.13 ft.	8. ft.

This table must not be taken to mean more than was intended. "None" does not mean that a reservoir under the given conditions would not contain water at any time in the whole year. It might be full after a storm, yet the average expectation of finding water there at any date when it is needed for irrigation is correctly expressed by zero.

[1] The formula for computation is $\frac{R \times r \times r'}{100} - (e + s) = D$, in which R = rainfall, $\frac{r}{100}$ = run off, r' = ratio of basin to reservoir, e = evaporation, s = seepage, and D = annual average depth of water resulting from the given conditions.

The table is intended merely for a quantitative expression of results which will follow if the assumed data are fairly correct. And, if they are somewhat erroneous, whoever knows a more accurate value for any factor can readily insert it, and correct the table. Quantitative expressions, even when based upon assumptions and hypotheses, are more instructive than vague and speculative generalizations. This table, for instance, shows certain limitations of water storage so narrow and rigid that any errors which are likely to be detected in the assumed data will not overcome them.

To specify some of these limitations, take the first column of the table. It means unmistakably that no storage can be made from a rainfall of one foot. The highest ratio, that of 100:1, a ratio which can seldom be realized, gives only six inches as the permanent average depth of water in the reservoir. None of the assumed data can very well be so far astray that its correction will raise the amount to a reliable irrigation head of water. Possibly full at one time, but dry as a powder-horn at other times, such a reservoir would be useless, because it would be unreliable. Certainty — that most valuable feature of farming by irrigation as opposed to an enforced dependence upon the fickle goddess of weather in the rain-belt — would be lost. The farmer must have the water just when he needs it, not just when it happens to come. The figures for average annual depth show the maximum which can be relied upon with certainty at any given date. While it might sometimes be greater, there is no rational assurance of it.

The seasonal distribution of the rainfall is so far favorable to a speedy use of stored waters, without serious loss by evaporation, as to make the case somewhat better than appears in the table. But over against this is the neutralizing consideration that the greater rainfall of spring and summer is more fully absorbed than the lighter precipitation of winter upon frozen ground. Melting snows yield a greater run-off than summer rains. This increases the average period of storage before use, and correspondingly diminishes the chances of success.

These changes are still too slender to be at all reliable if the rainfall is fifteen inches. Indeed, it is not until we come to the column headed "18 inches" that we find any encouragement. One result at the bottom of that column looks hopeful, but that calls for a catchment surface one hundred times as large as the reservoir — a condition which, when coupled with the further limitation of enough good irrigable land under the reservoir, not one farm in a hundred can fulfil.

The promising figures are twice as numerous in the next column, and three times as numerous in the last. But even with two feet of rainfall the chances of failure and success are about even. The ratio must be at least 75:1, or a mean between the lowest and highest in the table.

For areas having a greater rainfall than two feet, where the impounded waters might be useful for other purposes, but would hardly be needed for irrigation, the possibilities of storage may be easily discovered by extending the table.

Water storage upon the high mesas of the treeless belt is, if not wholly a delusion, at least somewhat delusive. More hopeful is the expedient of deep tillage, which is also a sort of storage. Hidden from sun and winds in the loose soil and sub-soil, the moisture will thus be preserved at the very spot where it is needed to sustain vegetation.

L. E. HICKS.

DR. BAILLON'S "Dictionnaire de Botanique," the publication of which was commenced in 1869, is now completed.

THE SOPHISTICATED FRENCH WINES.

LOVERS of the glass that is alleged to exhilarate with moderation, and more especially those whose glances melt at the sight of French labels, will be interested in a report recently made to the French Academy of Science by three celebrated chemists. Our California vintners, too, whose machine-made wines by a chemical miracle become five years old within ten days from the press, will also find something to interest them. The report was made *apropos* of a question submitted by the Paris Chamber of Commerce whether it was permissible to use the salts of strontium to precipitate the excess of plaster added to wine by vintners. The question was referred by the Academy to a committee composed of MM. Berthelot, Duclaux, and Gautier. These eminent *savants* made the following report: —

"For above thirty years the employment of plaster in the manipulation of wines has been general throughout the south of France. A recent law has decreed that the maximum quantity of sulphate of potassium per litre in merchantable wine shall be two grams, and therefore the wine trade demands a method for reducing the quantity of sulphate in wines on hand to the legal limit. Some of these have already begun to use for this purpose a mixture of tartrate of strontium and tartaric acid. These substances added in the right proportion cause the precipitation of sulphate of strontium and the solution in the wine of bitartrate of potassium. This operation replaces in the wine the tartrate of potassium removed by the plaster, but unfortunately the wine also retains in solution more or less of tartrate of strontium. This salt is not a normal constituent of wine. It is not found in any food-stuff, though it exists in some mineral springs, as, for instance, those of Vichy. When pure, these salts are not believed to be poisonous in ordinary doses.

"The question submitted by the Chamber of Commerce includes in effect a question of principle and one of fact. In principle one might say that, wine being a natural product, the addition of any chemical substance whatever should be looked upon as a falsification, more especially is this the case when the purpose of the substance added is to mask the real character of the wine and deceive the purchaser as to the real nature of the merchandise he purchases.

"Moreover, it appears to the committee that to furnish the Chamber of Commerce with a method for deplastering wines will in effect throw the authority of the Academy in favor of plastering, and will, furthermore, seem to promise a further scheme for destrontianizing the wine, to use a neologism, and so on, *ad infinitum*.

"It is necessary to define clearly the point where wine ceases to be a natural product and becomes a chemical fabrication. It is to the interest of no one, either among the vintners or among the merchants, to furnish grounds for proclaiming to the world that French wines are artificial products made, not by vintners, but by chemists. The authority of the Academy cannot be used for any such purpose. So much for the question of principle; now as to the facts: Though strontium may not be a poison in ordinary doses, and even though it may serve as a useful medicine in certain cases, it is by no means certain that when used in sensible doses, as it must be if it becomes a constituent of an alimentary substance in such common use as wine, it will be without effect upon the bodily functions. It is necessary to be not merely prudent but even timid in deciding whether or not to introduce into the bodily circulation mineral elements which normally do not exist there. Such substances, even when apparently innoxious at first, may by their accumulation in the body produce at length very grave consequences. What may be innoxious to some persons may be ruinous to others, according to temperament or pre-existing maladies. The experiments of M. Soborde have shown that tartrate of strontium may produce congestion of the kidney in animals. Still, further, it must be remembered that therapeutic experiments with strontium have been conducted with a chemically pure salt. The strontium of commerce is always more or less mixed with salts of baryta, which are not easily separated, and which are very poisonous. The danger would be very great were these salts to become articles of ordinary commerce, to be used without discrimination or control by vintners and wine merchants. These would buy their supplies in the cheapest markets without regard to purity. We know, too, how difficult it is to use such substances in such exact proportions as to get just the desired reaction among the elements employed.

"For these reasons the committee recommends that the Academy reply to the Chamber of Commerce that it declines to approve of the employment of salts of strontium for deplastering wines, and reprobates such practices."

At a subsequent sitting of the Academy M. Quontin contributed the result of a study of deplastered wines. The process of deplastering is used only for the purpose of reducing the contents of the wine in potassium sulphate to the legal limit. M. Quontin found in the course of his researches that not only are the chloride, nitrate, and carbonate of baryta commonly used, but also that the tartrate, acetate, and phosphate are employed for this purpose.

M. Berthelot, in discussing M. Quontin's paper, said that the facts brought to light by M. Quontin's researches bore a character of very grave interest. The deplastering of wines by means of the salts of baryta was not merely a method of falsification of a common alimentary substance, but a real, wholesale manufacture of poisons.

GERALD MCCARTHY.

North Carolina Experiment Station.

A BOTANICAL LABORATORY.

FORMERLY the botanical laboratories were given up almost entirely to systematic and structural work, this being as much a matter of necessity as of choice, for the physiological and bacteriological work are comparatively new branches of the science of botany, requiring specially designed apparatus, which is often very costly. Of late years, however, the great scientific and economic value of the latter subjects is being realized, and laboratories are being equipped in which these lines can be pursued.

One of the finely furnished physiological and bacteriological laboratories of this country is that at Purdue University Experiment Station, La Fayette, Ind., equipped by Dr. J. C. Arthur. The laboratory consists of five rooms beside the greenhouse, these being a general laboratory in the centre, a library and herbarium to the west, a bacteriological room to the east, and a store-room and dark room to the north. The general laboratory has a large window, occupying nearly the whole width of the south side of the room, furnished with light lower curtains and a dark heavy upper one. These can be adjusted so as to tone the light on a bright sunny day, and allow the entrance of all the light possible on a gloomy day. In front of the window is a long table fastened to the wall to prevent vibration as much as possible; this is used for microscopic work. The walls are lined with wall cases and cases of drawers for reagents, glass-ware, and apparatus in immediate use. There are tables with gas and water supply; a sink with hot water apparatus and cleated shelves for drying purposes; and drying and constant-temperature ovens. Accompanying the reagent case is a card catalogue, which indicates very nearly the arrrngement of reagents, so that the time taken to find one is reduced to the minimum.

Among the pieces of apparatus in the room are auxanometers, clinostats, electric and mercuric thermo-regulators, hot stages, dialyzers, pressure regulators, chemical, torsion, and ordinary balances, dynamometers, an electric motor, transpiration tubes, etc.

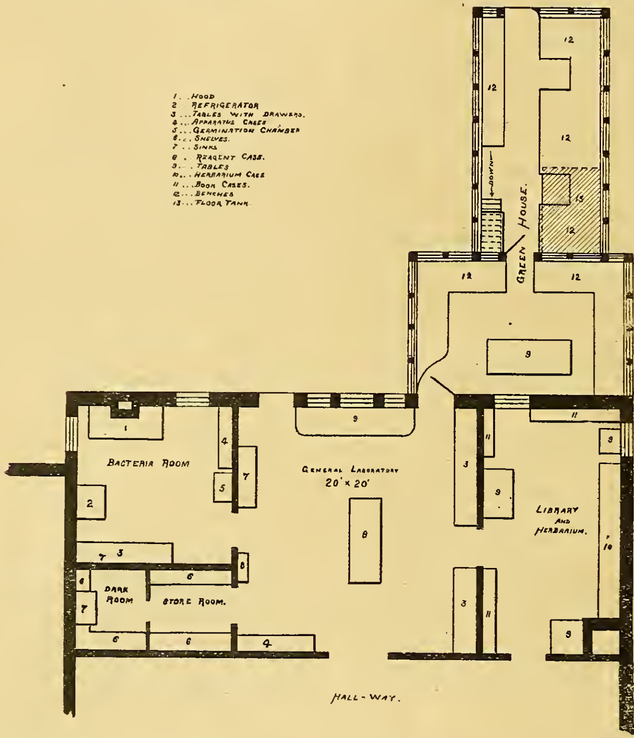
The bacteriological room has a south and east light, and is fitted up with the latest appliances; such as steam and dry-air sterilizers, germination ovens, bulb and ordinary culture tubes, and all the various paraphernalia used in bacteriological work. There is a large table with sink, having a water supply, and cases of drawers for supplies of cotton, agar, gelatine, cages, etc., a case of stains, and a large hood with water supply in which the steam sterilizers are placed.

The library and herbarium on the opposite side of the general laboratory to the bacteriological room contains the standard works, and as Dr. Arthur's private library is kept here besides, there are many valuable and rare works to which one does not usually have the good fortune to have access. There is also a good supply of botanical journals both in English and foreign languages. The library is specially well supplied with works on plant diseases, parasitic fungi, and physiological subjects. The library is carefully catalogued.

The herbarium contains both phanerogams and cryptogams, parasitic fungi being specially well represented.

In the store room are kept the supplies not in immediate use. Leading from the store-room is the dark room for photographic work ; this room being supplied with gas, water, a specially arranged sink, and the chemicals and appliances needed in the work.

A small greenhouse extends south from the station, its main room opening directly from the laboratory and on the same level. This room is fitted up with tables and benches upon which apparatus can be placed when the student is working with the living plants. The smaller room is on a lower level, and is kept at a lower temperature than the main room. Experiments can thus be carried on with plants at different temperatures. There are also in this room a floor tank for aquatic plants, and steam-heated cutting beds. Both rooms are heated by steam. The greenhouse forms a very useful adjunct to the laboratory.



The laboratory in the Station is entirely separate from the University laboratory, the latter being under the direction of Dr. Stanley Coulter; the work there is in systematic and structural botany. The students in Dr. Arthur's laboratory who do the physiological and bacteriological work are juniors and seniors who have elected botany and have done the systematic and structural work previously. There are also post-graduate students who are doing original work.

Katherine E. Golden.

THE DISTRIBUTION OF FISHES.

A good illustration of the amount of change brought about by deep-sea investigations in our ideas of the distribution of the fishes is to be seen in the recent history of the Discoboli. A short time ago it was supposed all the representatives of this group — the Discoboles, disk-bearers, lump-fishes, sucking-fishes, or sea-snails, as they are variously called — were restricted to the Atlantic and Pacific, in their northern parts, and to the Arctic Ocean. This was previous to 1870. At that date species were known of each of the families of the group. From the Atlantic section there were two species of the Cyclopteridæ — Cyclopterus lumpus and Eumicrotremus spinosus — and five species of the Liparididæ — Liparis montagui, L. liparis, L. tunicatus, Careproctus major, and C. Reinhardi. And from the Pacific the list contained one species of the Cyclopteridæ, Eumicrotremus orbis, two species of the Liparopsidæ, Cyclopterichthys ventricosus and Liparops stelleri, and five species of the Liparididæ — Liparis mucosus, L. calliodon, L. Agassizii, L. pulchellus, and Careproctus gelatinosus.

Between 1870 and 1891 the additions from the Atlantic were four species of the Liparididæ — Careproctus micropus, Paraliparis bathybius, P. liparinus, P. membranaceus. In this period the northern Pacific had yielded one species of the same family, Paraliparis rosaceus. But the more important additions in this time were from the southern end of the American continent, whence came one species of the Liparopsidæ, Cyclopterichthys amissus, and three species of Liparididæ—Liparis antarctica, L. Steineni, and L. pallidus (one or more of which may yet prove to be young of Careproctus). Previous to 1891 this was the state of our knowledge of the Discoboles; and the generally accepted idea of their distribution limited them to the far-north and to the far-south, and displaced them in the tropics by other disk-bearers belonging to very distinct families, the Gobiidæ and the Gobiesocidæ. As such a number of the Discoboli were deep-sea forms, and as the anatomy in general was that of types adapted to a life far below the surface in low temperatures, there seemed to be no reason for supposing them absent from great depths under the torrid zone. These considerations induced me, in monographing the group for this museum, to predict that eventually the proper distribution would be found to extend from the northern to the most southern localities on the sea bottom (Mem. Mus. Comp. Zool., XIV., No. 2).

Since 1890 a new genus, Cyclopteroides, and new species have been added to the number of Discoboles known from the North Pacific. They, however, did not affect the distribution previously determined. It remained for the United States Fishery Commission steamer "Albatross," under Commander Tanner, to supply what was needed to verify the prediction. Among the fishes collected by this vessel while dredging off the west coast of Central America, in charge of Professor Alexander Agassiz, I find representatives of two species which place the sub-equatorial distribution beyond question. These specimens were secured within four degrees of the equator, at depths of more than 1,700 fathoms, in temperatures of about 36° F. They are figured and described in the forthcoming report on the fishes of these explorations, under the names Careproctus longifilis and Paraliparis fimbriatus. By their capture the Artarctic are connected with the Arctic localities, and the range of the Discoboli is proved to be one of the most extensive among the fishes, though the affinities and habits of those we now know are such as indicate that the present list of the species lacks much of being complete.

But the modifications of our ideas by deep-sea exploration, as will be shown in a later writing, are not confined to a particular group. Our conclusions respecting numbers of the families with which we had supposed ourselves well acquainted have been affected directly, through new species and extended ranges, and indirectly, through peculiarities of anatomical or other relationships that appear as evidences of the existence of allied forms not yet known, and of yet to be discovered centres of distribution serving as sources of replenishment for the fisheries, retreats for recovery from depletion, or as possible new grounds for our fishermen.

S. Garman.

Museum of Comparative Zoology, Cambridge, Mass., Mar. 7.

NOTES AND NEWS.

A new "Jahrbuch der Chemie" is to be issued by the German publisher, H. Bechhold, Frankfort. It will be edited by Professor R. Meyer, who has secured the co-operation of many eminent men of science. The intention is that the progress of pure and applied chemistry shall be recorded every year in a connected series of articles.

— Japan has no fewer than 700 earthquake-observing stations scattered over the Empire, and the Tokio correspondent of the London *Times* is of opinion that they are all needed. He points out that not only are the Japanese shaken up by fully 500 earthquakes every year — some of them more or less destructive — but at intervals there comes a great disaster, amounting, as in the earthquake of Oct. 28, 1891, to a national calamity. Japanese annals record twenty-nine such during the last 1,200 years.

— The volcano of Kilauea is very active at present. The cavity produced by the last breakdown has not filled up, but there is an active lake two or three hundred feet below the general level of the floor and a quarter of a mile in diameter. Rev. S. E. Bishop of Honolulu says the whole plateau of Halemanman is steadily rising. It is evidently being pushed up by lava working underneath and not built up by overflows. Professor W. D. Alexander, in charge of the Trigonometrical Survey, writes that his assistant, Mr. Dodge, will probably re-survey the crater during the coming summer, for the purpose of comparing the present topography with that delineated in *Science*, vol. ix., p. 181, 1887. The Volcano Company is constantly improving the facilities offered to visitors for inspecting the crater.

— It sometimes happens that peat bogs swell and burst, giving out a stream of dark mud. Herr Klinge, as we learn from *Nature*, has made a study of this rare phenomenon (*Bot. Jahrb.*), of which he has found only nine instances in Europe between 1745 and 1883 (seven of these being in Ireland). Heavy rains generally occur before the phenomenon, and detonations and earth vibrations precede and accompany it. The muddy stream which issues, of various fluidity, rolls along lumps of peat, and moves now more quickly, now more slowly. After the outbreak, the mud quickly hardens, and the bog sinks at the place it appeared, forming a funnel-shaped pool. The bogs considered by Herr Klinge have been almost all on high ground, not in valleys. He rejects the idea that the effects are due to excessive absorption of water by the bog. The peat layers, which often vary much in consistency, have each a certain power of imbibition, and the water absorbed does not exceed this limit. Excessive rain affects chiefly the upper layer not yet turned into peat and the cover of live vegetation, which gets saturated like a sponge, after which the water collects in pools, and runs off in streams. The theory of gas explosions is also rejected; and the author considers the real cause to lie in landslips, collapses, etc., of ground under the bog, permitting water or liquid mud to enter. This breaks up the bog mechanically, mixes with it and fluidifies it, and an outburst at the surface is the result. The limestone formations in Ireland, with their large caverns and masses of water, are naturally subject to those collapses, which, with the vibrations they induce, are more frequent in wet years. The heavy rains preceding the bog eruptions are thus to be regarded as only an indirect cause of these.

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THE PATENT OFFICE BUILDING.

We have recently referred to the condition of the United States Patent Office as revealed by the reports made at the meetings of the Association of Inventors and Manufactures. It will be remembered that it was stated that either a new and much larger building is required for the work of that department of the Government, or a great extension of the present building and quarters. Every commissioner of patents for many years past has endeavored to bring this matter before Congress in such manner as to secure some relief, but without avail; and the condition of things in the building has now become, in consequence of the supineness of those responsible for it, as testified by the speakers in the discussion in the Senate reported in part below, something shameful and almost indescribable. It will be remembered also that the Patent Office building was erected many years ago, and especially for its present uses, at a cost of about $3,000,000, all furnished by the inventors of the country; but it is now so utterly inadequate to its work that clerks and other officers in the office are actually in danger of asphyxiation. But this is not all; this building, built with the money of inventors thus taxed for the privilege of making this country the most prosperous and wealthy on the globe, money contributed by poor inventors usually, is not now even permitted to be appropriated to the use for which it was constructed or the purpose to which it was dedicated; but the Interior Department, organized since the formation of the Patent Office, has been permitted to enter its "camel's nose" into this tent, and has now succeeded in getting so much of its body in that it actually dispossesses the rightful proprietors, and it has even been suggested by at least one secretary of the interior that the Patent Office be dispossessed entirely.

The Patent Office rightfully owns the building, which is paid for out of its own earnings at a cost of $3,000,000, and the accumulations of inventors' money in the treasury amount to about $4,000,000 more; nevertheless, it seems next to impossible to save the business of the country from further serious expense and enormous embarrassment through delayed cases, or to preserve the employees of the government from danger to health and life by the construction of a new building which might be, and should be, immediately constructed. It seems unfortunate enough that the present state of affairs should exist; but it seems doubly so when it is considered that poor inventors taxed for the benefit of a country which they have done so much to aid are not permitted to even build for themselves a building in which their work can be carried on in a business-like way, promptly and efficiently and at their expense. We quote from the *Washington Star*:—

"There was an interesting debate on local public buildings in the Senate yesterday afternoon. Senator Carey offered a resolution, which was printed in *The Star*, in which the committee on public buildings and grounds was called upon to report upon the condition of government buildings, the necessity for new buildings, the probable cost of the latter and the amount now annually spent for rent by the government.

"Senator Allison stated the rental expenditure as about $140,000 per annum. He did not object to the inquiry, but he thought it would do very little good. Everybody knew that public buildings were needed.

"Senator Hawley made several pertinent and forceful remarks as to the structurally dangerous and generally unhealthy condition of the government printing office.

"Senator Platt talked pointedly of the Patent Office. Said he: 'It is now at least eight years since I called the attention of the Senate to this matter. The difficulty has been increasing ever since. Although we have been taking business out of what is known as the Interior Department building, the danger, the overcrowding, the unhealthiness of that building have been increasing all the time, notwithstanding the room that has been made for the Patent Office. I said then, and I repeat now, that if there was a factory in the State of Connecticut where the employes were obliged to work under as unfavorable conditions as to health as the clerks in the Patent Office, the proprietors would be prosecuted and convicted under the laws of the State of Connecticut.'

"Senator Gray had been looking into the matter also. 'I had occasion,' said he, 'as a member of the committee on patents of this body, to visit the portion of the Patent Office building to which are assigned the documents and records which have made the tremendous weight that is jeopardizing the safety of that building, and though I expected to find some inconvenience there and a state of things which was very undesirable, I was not prepared to see what was exhibited to me, and I have felt ever since that there was a personal responsibility resting upon every member of this body and upon the co-ordinate body of Congress as long as that state of thing continues for the lives as well as for the health of those people who are compelled to labor there for their daily sustenance. I found a room there in which seventy or eighty ladies were performing their clerical duties that was so stifling that a half-hour's visit to that room made me so glad to get into the fresh air that I should be very unwilling to go back there again and stay the same length of time.

"'While we are waiting for the fire-proof building referred to, there is danger that some of these people may be asphyxiated in the interval, and I think, among all of the important questions that are pressing upon the attention of Congress, there is none more important and exigent than attention to this matter which has been brought up by the senator from Connecticut. I do not believe we can afford to wait a single day in giving our attention to some method of relief. I understand from the report made by the secretary of the interior that the quantity of air to each individual in the part of the building where these ladies worked is about 400 cubic feet, whereas Dr. Billings, the best authority perhaps in the United States or in the world on sanitary matters of this kind, says that human life cannot be healthfully continued without something like 4,000 cubic feet to the individual. I asked the gentleman who has charge of that room how they managed to get along at all, and he said that at intervals of about two hours or an hour and a half they had to ask all these people to go out of the room — in winter time, of course — so that they might raise the windows in order to change the air; otherwise they could not get along as well as they do. That condition of things is shameful as well as deplorable, and I think some action ought to be taken at once in the interest of the human beings who are compelled by their necessities to perform their duties under such circumstances.' "

THE STRUCTURE OF THE HEMIPTEROUS MOUTH.

OUR knowledge of the mouth parts of the Hemiptera is given by Professor Comstock in his valuable "Introduction" as follows: "The mouth parts are formed for piercing and sucking. Without dissection they usually appear as a slender, jointed beak, arising at the base of a shorter, pointed labrum. This beak consists of four bristles inclosed in a fleshy jointed sheath. Two of the bristles represent the

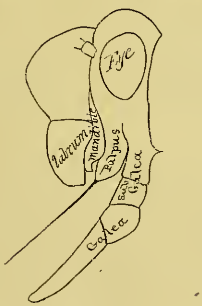

FIG. 1.

mandibles and two the maxillæ. The sheath is supposed to consist of the labium and grown-together labial palpi. This sheath is usually four jointed, and is never composed of more than that number of segments. The maxillary palpi are wanting." The results of my studies in the Diptera, Hymenoptera and on the pupa of Cicada, lead me to disagree with this explanation, or homology, of the parts.

The head of a Cicada pupa when softened and cleaned so that all the parts are easily recognizable, shows four divisions, or sclerites, forming the lateral margin of the head inferiorly. In Fig. 1 the sclerites are shown, pried apart for convenience of recognition, and without attempt at any but diagrammatic result. The anterior of the sclerites is the labrum, covering the base of the mouth, and normally appressed so close to the beak that the intervening structures are not visible. Behind the labrum and normally closely united to it is the mandibular sclerite, which has not been heretofore recognized, but which is exactly where it should be, compared with a mandibulate mouth. From the side this sclerite gives a mere indication of its character and from the firmness of the union shows that the mandibles are not mobile and therefore not functional. Cutting along the posterior suture of the mandible and then straight across so as to get

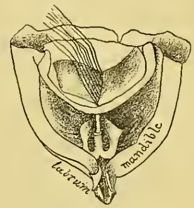

FIG. 2.

the whole of the labrum, we get from behind the view shown in Fig. 2. Here the mandibles show as elongated flattened strips, quite chitinous in texture toward the tips, which latter are acute and somewhat beak-like, divergent. The extremities lie so close to the pointed tip of the labrum that they are invisible from the side. In the cavity between the mandibular sclerite and the front of the labrum there is at least one large gland, probably that secreting the irritating fluid which many bugs inject into the punctures made by the beak. From this gland a distinct duct leads to the pointed

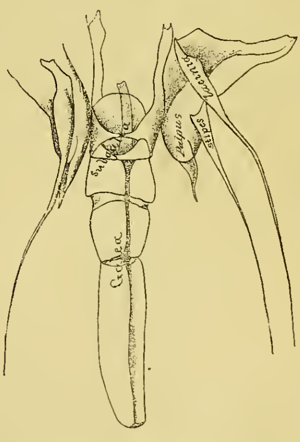

FIG. 3.

tip of the labrum behind and between two chitinous wings giving muscular attachments. In *Belostoma* the labrum is extended so as to cover the beak for half its length. Here there is a salivary gland behind the clypeus, the duct extending to the tip of the labrum and then apparently discharging into the beak. In some species the labrum is set inwardly with a coating of very fine, dense hair, giving a velvety surface, and this, as Dr. Packard has shown is the epipharynx. It is not present in the Cicada pupa. The sclerite next behind the manibular ring is that from which arise the two bristles that are usually homologized with the mandible and maxilla. That neither of them can be mandible follows from the fact that I have already demonstrated the true mandible. Removing the front rings altogether and spreading out flat the two posterior sclerites after removing the internal structures, we have the appearance shown in Fig. 3. In this figure we see the intimate connection between the beak and the maxillary structures. The two bristles are seen to arise from one base, and attached to the same source is the remnant of the maxillary palpus. The organ is much reduced, and probably not functional; but there is no doubt of its nature. By the pressure applied the base of the bristles is torn from the fastenings, which are distorted out of recognition. Figs. 4 and 5 give the true appearance. These two

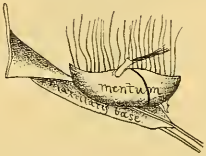

FIG. 4.

bristles represent the lacinia and stipes of the maxilla, developed in exactly the same way in which they are seen in the Diptera. In most species they are quite strongly modified at the tip and there is a permanent distinction in the character of the armature of the two bristles which will be of assistance ultimately in distinguishing the parts.

The remaining maxillary part, the galea, I identify with the beak, denying thus its character as labium and grown-together labial palpi. No one has questioned the fact that the beak in the Hemiptera is the homologue of the similar structure in Diptera, and this I have shown is a galear development. The steps in the development are clearly shown by studying a series of the long-tongued Hymenoptera in connection with the piercing Diptera including Erax and allies.

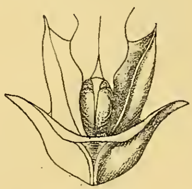

FIG. 5.

Exactly how the change to the normal Hemipterous structure occurred, I have not yet been able to ascertain. In this view the basal segment of the beak through which it is attached to the other maxillary parts, represents the cardo; the second joint the subgalea; while the third and fourth represent the two joints of the galea. In the apparently three-jointed beak the basal segment is so intimately connected with the head that it seems to form a part of it. Dissecting away all tissue from the head and leaving only the cardo of the maxilla and the other internal mouth structures attached thereto, we have the appearance from behind shown in Fig. 5. Centrally there is a boat-shaped structure, on either side of which there is a flat chitinous plate with two leaf-like membranous processes attached. On each side of this central plate, and imbedded in the tissue, is one of the lancets. Seen from the side, as in Fig. 4, the boat-like form of the central organ is more obvious as are also the maxillary base and the lancets issuing therefrom. This boat is formed of two parts closely united along a suture which is parallel to the line of the suture separating the labrum, the anterior portion belonging in the cavity behind the labrum, the remainder belonging to the central head cavity. That portion of the process belonging in the frontal portion of the head is shown in Fig. 2 superiorly. Through the centre of this boat on the inside is a thin membranous plate, longitudinally furrowed in its centre, and from this central furrow sending up long flat filaments, the nature of which I have not recognized. This boat-shaped process I homologize with the mentum in mandibulate insects, the fulcrum of the Diptera. It is all that remains of the labium or second maxilla, if my interpretation of the structures is correct. Exactly at what point in the development the missing structures were lost, I cannot yet say; it will require close study in groups in which I have as yet no material at all. I am confident, however, that the above explanation of the homology of the structures will prove the true one. JOHN B. SMITH.

Rutgers College, N. Y.

THE ETYMOLOGY OF THE TWO IROQUOIAN COMPOUND STEMS, -SKĔⁿ'-RA-KEQ'-TE' AND -NDU-TA-KEQ'-TE'.

STUDENTS of Iroquoian terms have made attempts to analyze these two interesting compound-stems, but in making these analyses they overlooked the force and exact meaning of the component elements of these two stems, and so the etymologies they have put forth are erroneous. Too much weight was given to so-called "accepted authority," and indiscriminating compilation took the place of careful research.

It appears from the evidence of language that hitherto all students who have attempted to analyze these two compound terms have been misled by a mistranslation of the noun *Gaskenra*, made by Father Bruyas in his work mentioned below.

The writer will here cite what has been written by him upon the two stems in question as well as what has been written upon them by other authors who have had access to his writings. This is done for the purpose of showing to what extent Bruyas's erroneous translation has been an embarrassment to all his copyists; for they invariably quote his wrong definition of the noun in question, and yet make remarks, the reasons for which should have led them to the true etymology and signification of the elements and terms in question.

Father Bruyas[1] succinctly says, "*Gaskenra*, la Guerre. Inde *hoskenragetete*. S. 2ae conj. soldat." Again, on page 83 of the same work, he writes, "*Onn8ta*, coton, duvet." And immediately below this, "*Nond8tage*^{c}*te*, la Guerre. *Hotinnond8tagetete*, les soldats."

Father Cuoq, following his predecessors in Iroquoian glottology, writes,[2] "*Oskenra*, vieux mot qui n'est plus guère usité qu'en cp. avec le v. wakkehte, porter. Il devait signifier la *guerre* ou plutot qq. instrument de guerre. Roskenrakehte, au pl., rotiskenrakehte, homme de guerre, guerrier, militaire, homme portant armes." This citation may be translated thus: "*Oskenra* [is] an old word which is not much in use now except in composition with the verb *wak-*

[1] "Radices Verborum Iroquæorum," Neo-Eboraci, 1863, p. 98.
[2] "Lexique de la Langue Iroquise," Montreal, 1882, p. 36.

kehte, to carry. It must have signified war, or rather some instrument of war. *Roskenrakehte*, *rotiskenrakehte* in the plural, a soldier, warrior, martial man, man bearing arms." Again, on page 35 of the same work, we find, "*Onota*, jonc," i.e., *Onota*, "a rush or reed," being the *onn8ta* of Father Bruyas.

Following M. Cuoq, Mr. Horatio Hale says,[1] "*Oskenra* is an ancient word for war. *Kakehte* is to carry. The compound word, *roskenrakehte*, means 'one who carries on war.'"

Lafitau, although clearly pointing out the true origin of the two compound stems in question, fails to deduce from it the exact etymology of either stem. He was evidently misled by the mistranslation of *gaskenra* by la guerre, war, made by Father Bruyas, as cited hereinbefore, for *ka-skĕ*$^{n'}$'*-ra'* does not signify war. Before making an analysis of the terms at issue, the writer will here quote at length what Lafitau has written upon them. He says,[2] "Les Iroquois et les Hurons, nomment la Guerre *n'Ondoutagette* et *Gaskenrhagette*. Le verbe final *Gagetton*, qui se trouve dans la composition de ces deux mots, et qui signifie Porter, marque bien qu'on y portoit quelque chose autrefois, qui en étoit tellement le symbole, qu'elle en avoit pris sa denomination. Le terme *Ondouta*, signifie, le duvet qu'on tire de l'épy des Roseaux de Marais, et signifie aussi la plante toute entiere, dont ils se servent pour faire les nattes sur quoi ils couchent, de sorte qu'il y a apparence qu'ils avoient affecté ce terme pour la Guerre, parce que chaque Guerrier portoit avec soy sa natte dans ces sortes d'expeditions. En effet la natte est encore aujourd'huy le symbole qu'ils representent dans leurs peintures Hieroglyphiques pour désigner le nombre de leurs campagnes. Pour ce qui est du terme *Gaskenrha*, il est si ancien que les Sauvages eux-mêmes n'en sçavent plus la signification. Mais comme il seroit inutile de courir après des étymologies, sur lesquelles les naturels du païs sont embarrassés eux-mêmes, il me suffit de dire, que tout ce que les Sauvages portent dans leurs courses militaires, se reduit à leurs armes, à quelques ustenciles necessaires dans les campemens, et à quelques provisions de farine preparées de la maniere, dont je l'aï expliqué." This quotation may be rendered thus: "The Iroquois and the Hurons call war *n'Ondoutagette* and *Gaskenrhagette*. The final verb *Gagetton*, which is found in the composition of these two words, and which signifies to bear or to carry, shows, verily, that heretofore something was borne to it [i.e., to war] which was a symbol of it [i.e., of war] to such a degree that it [war] had assumed its [the symbol's] designation. The term *Ondouta* signifies the down [the wool-like substance] which is taken from the ear [cat-tails] of marsh-reeds, and it also denotes the entire plant, which they use in making the mattresses (nattes) upon which they lie, so that it appears that they applied this term to war, because every warrior, in this kind of expeditions, carried with him his own mattress. In fact, the mattress is still to-day the symbol employed in their hieroglyphic picture-writing to denote the number of their campaigns. As to the term *Gaskenrha*, it is so old that the Savages themselves no longer know its meaning. But as it would be profitless to run after etymologies concerning which the natives of the country themselves are perplexed, it suffices me to say that the entire equipage of the savages in their military expeditions consists of their arms, of some necessary utensils for the encampment, and of some provision of meal prepared in the manner which I have explained." Again, on page 46 of the same Tome, while discussing the monogrammatic or hieroglyphic picture-writing of the Indians, Lafitau says, "Le nombre des expeditions est designé par des nattes. On distingue celles où il s'est trouvé, et celles où il a commandé, en ce que ces dernieres sont marquées par des colliers attachés à la natte." This citation may be rendered thus: "The number of expeditions is denoted by mats or mattresses (des nattes). There is a distinction made between those wherein one was merely a member and those wherein he commanded, in this, that the latter are designated by having wampum-strings attached to them."

It is only by a figure of speech,—by metaphor,—that either one of the compound stems, *n'Ondoutagette* or *Gaskenrhagette*, signifies war or warfare, for neither of the component nouns of the two stems is denotive of war, nor does the verb-stem with which they are compounded signify warring or to make war.

In the following lines, the alphabet used in the orthography of the Iroquoian terms and stems, other than those quoted, is that of the Bureau of Ethnology, Smithsonian Institution.

The verb-stem *-keq-te'*, although having the form of the perfect tense of a simple verb, the present tense form of which is now not in use (being no longer a living form of the verb), has the force and meaning of a present tense; and it is for this reason that its personal or pronominal affixes are those of the perfect tense of regular verbs. It has a specific meaning only; namely, to bear or rather bearing [something] on the back [by means of the forehead strap]. Hence, for the purposes of etymology, to translate it simply by such general terms as "to bear," "to carry," and "to carry on," is a mere waste of time and a confession of the ignoring of its only and specific meaning which requires its composition with such nouns of things only which may be borne on the back. Indeed, the name of the forehead-strap, *ka-keq'-ta'*, is derived directly from it, the initial *ka-* being only a gender sign, and the final *-a'* a nominal formative.

In the compound stem *n'Ondoutagette*, cited by Lafitau, the initial *n* and apostrophe are used for the definitive *ne* pronounced as a proclitic. The noun in it is *on-du'-ta'* (Ondouta), which signified a reed or rush, the material for mat and mattress-making; the down, or cotton, of reeds, rushes, and plants; and, lastly, the war-mattress or war-mat.

To confirm what has been advanced in support of the writer's definition of the word *on-du'-ta'*, he will cite what is found in the "Huron Grammar" of Père Pierre Potier, dated about 1750. Therein are to be found the following entries, "*kandōta*, jonc à nattes," i.e., reed or rush for mats; again, under "Meubles d'une Maison," is to be found "*ondōta*, natte de guerre, i.e., war-mat or war-mattress. This is conclusive evidence as to the early meaning of *on-du'-ta'* as pertaining to warfare. Hence, *on-du-ta-keq'-ta'*, the participial form, signifies, etymologically, "bearing a war-mat or mattress on the back." Replacing the initial gender-sign *o-* by the masculine pronoun of the singular third person of the anthropic gender, *ho-*, he, we have *hon-du-ta-keq'-te'*, "he bears a war-mattress on the back," which was one of the customs of warriors on the war-path.

It has been said elsewhere in this article that *ka ske*$^{n'}$'*-ra'* (Gaskenrha) did not mean warring or warfare. Lafitau states, in the citation from his work above quoted, that, in his time, its meaning was unknown to the Indians themselves. But, misled by Bruyas's mistranslation of it, he

[1] "Transactions of the Buffalo Historial Society," vol. 3, p. 72.

[2] "Mœurs des Sauvages Ameriquains, Comparées aux Mœurs des Premiers Temps." Tome II., 194-5 pp. Paris, 1724.

doubtless asked them if the word meant war, and, receiving a negative reply, he at once inferred that as it must be an archaic word for war its signification had been forgotten by the Indians; for was it not still the component element in a compound meaning war and warrior? This inference, however, was erroneous.

Since it is compounded with the verb-stem *-keq-te'*, it must like *on du'-ta'* signify something which had to be borne on the back by the warrior. Under the heading, "Meubles, mesnages, outils," i. e., "Family or household goods, tools, etc.," Fr. Gabriel Sagard, in his "Dictionnaire de la Langue Huronne" (1632), wrote "Ballet, *Oscoera*." In the fifth edition of the "Dictionnaire de l'Academie Francoise," Paris, 1825, there are two forms of the word "ballet" given; one of these is "balle," signifying a large pack of goods, bound with cords, and wrapped in coarse linen cloth, and the other is "ballot," meaning a large pack or bundle of family or household goods. The word bale is evidently the correct rendering of this word. But it is very improbable that a bale as such formed a part of the family and household goods and tools of the early Hurons. It is likely, however, that *oscoera* signified a mat woven from the common Indian hemp (Apocynum Cannabinum), and thus merely a form of the modern Mohawk, and perhaps proethnic, *oska'ra'*, flax, hemp, tow, the Tuskarora form of which is *u'-ska-rě*, meaning shawl, blanket, bedding, bed-cover, whatever is spread to lie upon; being found in *yä-ςka-re n'-kua'*, "one uses it to spread," which is a descriptive name of a carpet. Father Bruyas (on page 115, op. cit.) has "*Gentskaron*, estendre, mettre la natte," i. e., to spread or lay the mat or mattress; and "*Gentskare*, S. natte, avoir une natte," i. e., a mat, to have a mat, mattress. Père Pierre Potier (op. cit.) has "*kaskara*, tout ce qui sert à coucher," i. e., all that which is used for bedding. It is thus seen that the noun-stem *-skar-* has the same meanings that *-ndut-*, the stem of *on-du'-ta'* has, but it has a wider application in the modern vocabulary. There is no attempt made here to connect these stems etymologically, but a similar sematologic development only is shown in the two stems.

The stem of *ka sken 'ra'* is *-sken '-r-* or better *-sken 'r-*. In the stems *-skar-* and *-sken 'r*, we have two generic noun-stems, having the same consonnatic sounds, sustaining one to the other the same positions in the two stems respectively, but differing in the interconsonantic vowel which vocalizes them. Nevertheless, it is assumed that these two stems are derived from one and the same proethnic source. It is clear that the stem *-skar-* is the older form, in that it is the simpler of the two. The change of the mid-stem vowel *a* to e^n is explained by the presence of the "interrupted explosive," represented by an apostrophe before a following *r* and by the presence of a *k* immediately before the vowel changed. The cause of the change was the "interrupted explosive," which became a part of the stem by analogic metathesis, a procedure which is not unknown in this language. So that there exists no formidable phonetic difficulty in the way of regarding the two stems *-skar-* and *-sken 'r-* as derivatives from one and the same proethnic form, having the meanings possessed by the stem *-skar-*, already given above. Thus, it appears that *ka-sken 'ra'* meant a mat or mattress; and this is the meaning which is absolutely required by the verb stem *-keq-te'* with which it is compounded.

Thus, both the compound-stems *-sken '-ra keq-te'* and *-ndu-ta-keq'-te'* were denotive of a custom of the Iroquoian warrior when on the war-path. The pronominal prefixes have been suppressed for brevity's sake. Prefixing the pronoun of the third person masculine singular of the anthropic gender, *ro-*, to the first, we have *ro-sken '-ra-keq'-te'*, "he bears a mat on the back;" and *ho-*, a dialectic form of *ro*, to the other we have *ho ndu-ta-keq'-te'*, he "bears a mat on the back." So that in the baldest English a warrior was a "mat — or mattress — bearer," in the tongues of the Iroquoian peoples.

J. N. B. HEWITT.

Washington, D. C., March 15.

FORTHCOMING SCIENTIFC BOOKS.[1]

THE following is a list of scientific works which will be issued by various English publishers in the course of the spring: —

Messrs. Macmillan & Co. — "Essays on some Controverted Questions," with a Prologue, by Professor Huxley; "The Beauties of Nature," by Sir John Lubbock, F.R.S., illustrated; "Island Life, or The Phenomena and Causes of Insular Faunas and Floras," including a revision and attempted solution of the problem of geological climates," by A. R. Wallace, with illustrations and maps, new and cheaper edition; "The Apodidæ," a morphological study, by Henry M. Bernard, illustrated (Nature Series); "Experimental Evolution," by Henry de Varigny; "The Diseases of Modern Life," by B. W. Richardson, F.R.S., new and cheaper edition; "The Geography of the British Colonies" — "Canada," by George M. Dawson, "Australia and New Zealand," by Alexander Sutherland (Macmillan's Geographical Series); "Scientific Papers," by Oliver Heaviside; "The Algebra of Co-Planar Vectors and Trigonometry," by R. B. Hayward, F.R.S., assistant master at Harrow; "Key and Student's Companion to Higher Arithmetic and Elementary Mensuration," by P. Goyen, inspector of schools, Dunedin, New Zealand; "Arithmetic for Schools," by Barnard Smith, late fellow and bursar of St. Peter's College, Cambridge, carefully revised in accordance with modern methods by W. H. H. Hudson, professor of mathematics, King's College, London; "Blowpipe Analysis," by J. Landauer, authorized English edition by J. Taylor and W. E. Kay of the Owens College, Manchester, new edition, thoroughly revised with the assistance of Professor Landauer; "Nature's Story Books," I., "Sunshine," by Amy Johnson, illustrated.

The Clarendon Press. — "Mathematical Papers of the late Henry J. S. Smith, Savilian Professor of Geometry in the University of Oxford," with portrait and memoir, two volumes; "Plane Trigonometry without Imaginaries," by R. C. J. Nixon; "A Treatise on Electricity and Magnetism," by J. Clerk Maxwell, new edition; "A Manual of Crystallography," by M. H. N. Story-Maskelyne; "Elementary Mechanics," by A. L. Selby; "Weismann's Lectures on Heredity," Vol. II., edited by E. B. Poulton, F.R.S; "Epidemic Influenza," by F. A. Dixey.

The Cambridge University Press. — "A Treatise on the Mathematical Theory of Electricity," by A. E. H. Love, fellow of St. John's College, Cambridge, two volumes, Vol. I. in the press; "The Origin of Metallic Currency and Weight Standards," by W. Ridgeway, professor of Greek, Queen's College, Cork, and late fellow of Gonville and Caius College; "Solutions of the Examples in 'A Treatise on Elementary Dynamics,'" by S. L. Loney, formerly fellow of Sidney Sussex College, Cambridge.

Messrs. Longmans & Co. — "Darwin and after Darwin: an Exposition of the Darwinian Theory, and a Discussion of Post-Darwinian Questions," by George John Romanes, F.R.S., two volumes.

Messrs. A. & C. Black. — "Life in Motion, or Muscle and Nerve," a series of lectures delivered at the Royal Institution, Christmas, 1891, by John Gray McKendrick, F.R.S., illustrated.

Messrs. J. & A. Churchill. — "A Treatise on Hygiene," edited by Thomas Stephenson and Shirley F. Murphy, in two volumes, with numerous illustrations, Vol. I. nearly ready; "Chemical Technology, or Chemistry in its Applications to Arts and Manufactures," edited by Charles E. Groves, F.R.S., and William Thorp (with which is incorporated "Richardson and Watts's Chemical Technology"), Vol. II. "Lighting: Fats and Oils, Candles, Stearine, Gas, Electric Lighting:" "Materia Medica, Pharmacy,

[1] From Nature.

Pharmacology, and Therapeutics," by W. Hale White; "The Student's Guide to Diseases of the Nervous System," by J. A. Ormerod, with 66 illustrations; "A Dictionary of Psychological Medicine, giving the Definition, Etymology, and Synonyms of the Terms used in Medical Psychology, with the Symptoms, Pathology, and Treatment of the Recognized Forms of Mental Disorder, together with the Law of Lunacy in Great Britain and Ireland," in two volumes, edited by D. Hack Tuke.

Messrs. Whittaker & Co.—New volumes of the Specialists' Series—"Lightning Conductors and Guards," by Oliver J. Lodge, F.R.S., with numerous illustrations; "The Dynamo," by C. C. Hawkins and F. Wallis, with numerous original diagrams; "A Guide to Electric Lighting," by S R. Bottone, for householders and amateurs, with 77 illustrations. Whittaker's Manual Instruction Series—"Manual Instruction: Woodwork," by S. Barter, Organizer and Instructor for the London School Board, and to the Joint Committee on Manual Training of the School Board for London, the City and Guilds of London Institute, and the Worshipful Company of Drapers, with over 300 illustrations; "Leather Work, Stamped, Moulded, and Cut. Cuir-Bouillé, Sewn, &c.," by Charles G. Leland, author of "Wood Carving," with numerous illustrations. Whittaker's Library of Popular Science—"Mineralogy," by Dr. F. Hatch, with numerous illustrations; "Chemistry," by T. Bolas with many illustrations.

Messrs. Sampson Low & Co.—"Answers to the Questions on Elementary Chemistry, Theoretical and Practical (Ordinary Course), set at the Examinations of the Science and Art Department, South Kensington, 1887 to 1891," by John Mills, two vols., fully illustrated; "Chemistry for Students, consisting of a Series of Lessons based on the Syllabus of the Science and Art Department, and specially designed to facilitate the experimental teaching of Elementary Chemistry in Schools and Evening Classes," by John Mills, numerous illustrations; "Decorative Electricity," by Mrs. J. E. H. Gordon, with a chapter on Fire Risks by J. E. H. Gordon, and numerous illustrations by Herbert Fell, engraved on wood by J. D. Cooper; "Examination of Soils," by W. T. Brannt.

Messrs. George Philip & Son.—"Makers of Modern Thought; or, Five Hundred Years' Struggle (A. D. 1200 to A D. 1699) between Science, Ignorance, and Superstition," by David Nasmith, in two volumes; "Christopher Columbus," by Clements R. Markham, Vol. VII. of "The World's Great Explorers and Explorations"; "The Development of Africa," by Arthur Silva White, new and cheap edition, revised to date, with fourteen colored maps; "Philips' General Atlas," entirely new and revised edition, with several additional maps; "Philips' Systematic Atlas," for higher schools and general use, a series of physical and political maps of all the countries of the world, with diagrams and illustrations of astronomy and physical geography, specially drawn by E. G. Ravenstein; "Philips' Atlas of Astronomy," a series of seventy-two plates, with notes and index by Sir Robert Stawell Ball, F.R.S., Royal Astronomer of Ireland; "Tourists' Handy Volume Atlas of Europe," a series of colored maps, with notes, plans of cities, and complete consulting index, by J. G. Bartholomew.

Messrs. Swan Sonnenschein & Co.—"Animal Coloration," by Frank Beddard, Prosector to the Zoological Society, with four colored plates by P. J. Smit, and numerous wood-cuts; "Text-book of Embryology: Man and Mammals," by Dr. Oscar Hertwig, of the University of Berlin, translated and edited from the third German edition by Dr. E. L. Mark, Professor of Anatomy in Harvard University, fully illustrated; "Text-book of Embryology: Invertebrates," by Drs. Korschelt and Heider, of the University of Berlin, translated and edited by Dr. E. L. Mark, Professor of Anatomy in Harvard University, and Dr. W. M. Woodworth, Assistant Professor in Harvard University, fully illustrated; "Text-book of Geology," adapted from the work of Dr. Kayser, Professor in the University of Marburg, by Philip Lake, of St. John's College, Cambridge, fully illustrated; "The Geographical Distribution of Disease in England and Wales," by Alfred Haviland, with several colored maps; "A Treatise on Public Hygiene and its Applications in different European Countries," by Dr. Albert Palmerg, translated, and the English portion edited and revised, by Arthur Newsholme, fully illustrated; "The Photographer's Pocket-book," by Dr. E. Vogel. "Introductory Science Text-Books," additions—introductions to the study of "Zoology," by B. Lindsay, illustrated; "The Amphioxus," by Dr. B. Hatschek, of the University of Vienna, and James Tuckey, of the University of Durham, illustrated; "Geology," by Edward B. Aveling, Fellow of University College, London, illustrated; "Physiological Psychology," by Dr. Th. Ziehen, of the University of Jena, adapted by Dr. Otto Beyer, with twenty-two figures.

Messrs. Crosby Lockwood & Son.—"A Hand-book of Brewing, a Practical Treatise for the use of Brewers and their Pupils," by Herbert Edwards Wright; "A Treatise on Earthy and other Minerals and Mining," by the late D. C. Davies, third edition, revised and very considerably extended by his son, E. H. Davies; "Fuels: Solid, Liquid, and Gaseous, their Analysis and Valuation," for the use of chemists and engineers, by H. J. Phillips, second edition, revised and much enlarged.

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.*

On request in advance, one hundred copies of the number containing his communication will be furnished free to any correspondent.

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

The Bacillus of Influenza.

IN consequence of the inaccuracy of two articles which have recently appeared in *Science* on the subject of the bacillus of influenza, the undersigned considers it necessary to give the following detailed abstract of the preliminary publications which have appeared this year in the *Deutsche Medicinische Wochenschrift* regarding the isolation and cultivation of this organism, and its relation to the disease.

The bacillus of influenza was no doubt observed by Babes in 1890, but he describes a variety of other organisms as occurring in influenza, and his communications [1 2] show no more evidence than those of other authors of his having proved this or any other organism, to be peculiar to the disease. To the simultaneously published observations of Pfeiffer,[3] Kitasato,[4] and Canon,[5] we must look for definite information on this subject, and to them most certainly is due the credit of discovery.

Where the bacillus of influenza is found. The bacilli are found in large numbers in the sputa and bronchial secretion of those who are suffering from influenza, and also to a greater or less extent in the blood. The bacilli in the sputa have been obtained in pure culture after a new method by Kitasato, and, according to Pfeiffer, their number in sputa bears a direct relation to the progress of the disease, the bacilli disappearing together with the purulent bronchial secretion. Pfeiffer suggests, in view of this fact, that the sputa be regarded as infectious material. This author examined the purulent bronchial secretion of thirty-one cases of influenza, and in all found the bacillus, which will presently be described. In uncomplicated cases of influenza pure cultures of the organism were obtained. He reports six autopsies, in two of which he obtained pure cultures. The bacilli occur in enormous numbers and frequently are observed in the pus cells. The examination of the lungs showed that the bacilli penetrate from the bronchi into the peri-bronchial tissue and may even attain the pleural surface, where, in two of the autopsies the bacilli were obtained in pure cultures from the exsudate on the surface of the pleura. In almost every one of twenty cases examined by Canon the characteristic bacilli were observed to be present in the blood (see further under staining). He usually found four to twenty isolated bacilli in each cover-glass preparation. In six cases where

[1] Babes, V., Vorläufige Mittheilungen ueber einige bei Influenza gefundene Bakterien (Feb. 17–May 3). Centralbl f. Bakteriol., 1890, vol. vii., pp. 233-241, 460-464, 496-502, 533-538, 561-568, 598-606 (with six photographs).

[2] Babes, V., Ueber die bei Influenza gefundene feinen Bakterien (Feb. 11). Deutsche Med. Wochenschr., 1892, No. 6, pp. 113-115.

[3] Pfeiffer, R., Vorläufige Mittheilungen ueber die Erreger der Influenza (Jan. 14). Deutsche Med. Wochenschr., 1892, No. 2, p. 28.

[4] Kitasato, S., Ueber den Influenzabacillus und sein Culturverfahren (Jan. 14). Deutsche Med. Wochenschr., 1892, No. 2, p. 28 (reported to the Society of Charité Physicians, Jan. 7).

[5] Canon, P., Ueber einen Mikroorganismus im Blute von Influenzakranken (Jan. 14). Deutsche Med. Wochenschr, 1892, No. 2, pp. 28-29.

the temperature of the patient had fallen, he found the bacilli in groups of five to fifty. In three of these six cases the temperature of the patient did not rise again after it had fallen, and the bacilli found at the time of the fall of temperature, or shortly after, disappeared after three to six days. The bacilli have not been observed in other conditions, as shown by many control observations made of the sputa in cases of bronchial catarrh, pneumonia, tuberculosis, etc., and they have never been demonstrated in the blood under other circumstances.

Diagnosis of Influenza by the microscopical examination of the blood in obscure cases. Canon[1] has been able to diagnose obscure cases of influenza, especially where no cough or expectoration existed, by means of the microscopical examination of stained blood preparations. The reliability of the microscopical examination was demonstrated in six cases by culture control experiments — the bacilli in the cover-glass preparations being but few and isolated.

Morphology. The bacilli are very minute non-motile rods, one-half as broad as they are long (of the same width as B. murisepticus, about 0.2 μ) and occur in chains of three to four individuals.

Staining. The bacilli are stained by means of dilute Ziehl solution (carbolic acid, five per cent solution in distilled water, 100 cubic centimetres; alcohol, 10 cubic centimetres; fuchsin, 1 gram) or heated Löffler's methylene-blue, and, in consequence of the fact that the ends of the bacilli take up the stain more intensely than the rest of the organism (polar staining), they present the appearance, unless deeply stained (Canon), of diplococci when single, or of streptococci when several bacilli are united to form a chain. The bacilli do not stain well with basic anilins and the Gram method (Pfeiffer). They may be demonstrated in the blood of influenza cases as follows: A drop of blood flowing from the pricked finger tip, is brought in contact with a cover-glass and spread by means of a second cover-glass which is placed over the first. The cover-slips are then drawn apart, and we have two films of blood covering the surface of each, which we proceed to dry at room temperature. Place the cover-glass thus prepared five minutes in absolute alcohol, and from this into Czenzynke's solution (concentr. methylene-blue solution, 40 grams; one-half per cent eosin solution, in 70 per cent alcohol, 20 grams; aq. dest., 40 grams) for three to six hours at 37° C. On removal from the stain, wash with water, dry, and mount in balsam. This stain shows the red blood corpuscles red, the leucocytes and bacilli blue (Canon).

Cultivation of the bacillus of influenza. The bacillus requires 28° to 37° C. for its development. On 1.5 per cent sugar-agar Pfeiffer could not succeed in causing more than a second generation to grow, though minute characteristic colonies at first developed. On glycerine-agar Kitasato has succeeded in maintaining cultures alive up to the tenth generation. The colonies formed by the growth of the influenza bacillus on agar slant-cultures appear like minute watery drops, which are so small that they are easily overlooked. In a second culture, inoculated from the first, the tendency for the colonies to remain separate and distinct is more evident, this growth being regarded as perfectly characteristic. The colonies are observable by means of a hand-lens when 24 hours old.

In bouillon the growth at the end of 24 hours is poor, appearing first in the form of small particles suspended in the perfectly clear fluid. These small bacterial masses gravitate, forming a flocculent deposit and leaving the supernatant fluid clear. This mode of growth, as we know, shows them to be non-motile organisms.

Canon, in his first communication, stated that he had been unable to obtain a growth of the bacilli derived from the blood, either in bouillon, plain agar, sugar or glycerin agar. In his second publication[2] he describes a successful method he has employed for the isolation of the organisms. On account of the diminutive size of the colonies formed by the growth of the bacillus, their comparatively small number in the blood, and the fact that the blood in coagulating prevents a proper isolation of the colonies, Canon proceeded as follows: The use of Esmarch roll cultures was abandoned in favor of cultures on Petri dishes. Into the latter, not only was it possible to introduce a larger amount of blood and thus increase the number of colonies obtained, but also such cultures offered the advantage of being readily examined for the minute colonies of the bacillus by means of the microscope. The blood of influenza patients was obtained in the usual way from the finger-tip, which had been sterilized with sublimate and dried with alcohol and ether, and pricked with a needle or pen-point previously sterilized in the flame. An assistant watches that the blood as it wells forth does not coagulate, but that the drops are spherical in form. Eight to ten drops are smeared over the surface of the dish, and the latter placed at 37° C. The colonies are best seen along the margins of the smeared blood ("Impfstrich"), or in places where relatively little blood has been smeared.

Pathogenic qualities. Monkeys and rabbits are susceptible when inoculated with this organism. Guinea-pigs, rats, pigeons (Pfeiffer), and mice (Pfeiffer, Canon) are refractory.

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[1] Canon, P., Ueber Züchtung des Influenzabacillus aus dem Blute Influenzakranken (Jan. 21). Deutsche Med. Wochenschr., 1892, No. 3, p. 48.

[2] Canon, P., Ueber Züchtung des Influenzabacillus aus dem Blute Influenzakranken (Jan. 14). Deutsche Med. Wochenschr., 1892, No. 3, p. 48.

The Question of the Celts.

IT would interest me very much, and I believe it would many readers, if Dr. P. Max Foshay will adduce any positive evidence, linguistic, craniological, or artistic, to show, 1, That we have any means of deciding about the language of the Ligurians; 2, That the descendance of the Auvergnats from the Ligurians can be traced; or, 3, That the Euskarian dialects are related to the Ural-Altaic group. According to Dr. Heinrich Winkler, probably the highest living authority on the Ural-Altaic languages, the Euskarian or Basque language has absolutely no relation to any member of the group.

D. G. BRINTON, M.D.

Philadelphia, March 29.

AMONG THE PUBLISHERS.

IN the next number of *The Illustrated American*, No. 111, dated Saturday, April 2, will be commenced a series of illustrated articles by Professor Warren K. Moorehead, on the ancient and extinct race of people known as the Cliff Dwellers, formerly inhabiting that part of the country of the upper Colorado, the San Juan, and its tributaries. This scientific expedition has been sent out under the auspices of *The Illustrated American*. The progress and result of this expedition will be published from time to time in the columns of that excellent weekly.

— F. A. Davis, Philadelphia, has recently issued a book, by Hartvig Nissen, entitled "A B C of the Swedish System of Educational Gymnastics." Mr. Nissen is instructor of physical training in the public schools of Boston, and has been connected in a similar capacity with many of the leading educational institutions of this country and Europe. Since the Swedish system of educational gymnastics has been introduced into the public schools of Boston, it has become a necessity to have a practical hand-book, both for the teachers and the many homes where gymnastics are practised. It is with the purpose of giving plain answers to the most frequent questions that this book has been written.

— With the April number the *Review of Reviews* enters upon its second year. It has had an exceptional, if not an altogether unique, history. One year ago it was known only to a few discriminating readers, and its subscription list and news-stand sales required only a few thousand copies. Its edition the present month is 70,000 copies, and it is eagerly read in every State and Territory in the Union and in every part of Canada. No extraordinary efforts have been made to push the magazine. There has been very little canvassing done for it; no chromos have been given to its subscribers; no special inducements, such as an encyclypædia or a parlor organ thrown in as a gratuity or offered at half-price, have been offered by the publishers. The magazine has grown to an enormous circulation and to commanding influence simply upon its merits. Its readers have liked it and therefore recommended it to their friends. It owes not a little to the newspapers of the country, which have appreciated the journalistic enterprise and vigor and the enormous amount of hard, honest labor put into every number, and which have most heartily recommended it to their readers. While working in the closest co-operation with the English *Review of Reviews*, edited by Mr. W. T. Stead in London, the American *Review* is a distinct magazine, wholly and entirely edited, printed, and published in New York, and in the fullest sense of the word as much an American periodical as Mr. Stead's London edition is an English periodical. The general aims and purposes, plans and methods, of the two magazines are identical, and each has the fullest access in advance to all the materials and illustrations prepared for the other. The American *Review*, being somewhat larger and higher priced, is more profusely illustrated. It has twenty or thirty more pages each month than the London edition. Its bound volumes, covering the past year, are a history of current action and thought, and a portrait gallery containing the faces of seven or eight hundred people of contemporary note, representing all parts of the world.

CALENDAR OF SOCIETIES.

Philosophical Society, Washington.

Mar. 26.—S. P. Langley, A Biographical Notice of General Meigs; Lester F. Ward, The new Psychology and what it Promises; T. Russell, River Stage Predictions.

Publications received at Editor's Office.

ADAMS, OSCAR FAY. The Presumption of Sex and other Papers. Boston, Lee & Shepard. 16°. 149 p. $1.
BERNHARDT, WILHELM. Anderson's Bilderbuch ohne Bilder, with notes and vocabulary. Boston, D. C. Heath & Co. 16°. paper, 127 p. 35 cts.
BOTTONE, S. R. A Guide to Electric Lighting. New York, Macmillan & Co. 160°. 189 p. 75 cts.
BUTLER, N. M. The Place of Comenius in the History of Education. Syracuse, C. W. Bardeen. 16°. paper, 20 p.
CHENEY, SIMEON PEASE. Wood Notes Wild: Notations of Bird Music. Edited by J. W. Cheney. Boston, Lee & Shepard. 12°. 276 p. $2.
EVERETT, C. C. AND OTHERS. The New World: a Quarterly Review of Religion, Ethics and Theology. Boston, Houghton, Mifflin & Co. Vol. I. No. 1. 8°. 200 p. 75 cts. $3 a year.
STORER, F. H. Agriculture in some of its relations with Chemistry. 4th ed. New York, Charles Scribner's Sons. 2 vols. 8°. pp. 561, 598.
SYME, DAVID. On the Modifications of Organisms. Melbourne, George Robertson & Co. 12°. 172 p

SCIENCE

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SCIENCE

NEW YORK, APRIL 8, 1892.

THE NEW METHOD OF PROTECTING BUILDINGS FROM LIGHTNING.

In April last I read a paper on my new method of lightning protection, before the American Institute of Electrical Engineers. This paper and the discussion were published in *Science* of May 8 and 15, 1891.

In that paper I stated that, simply as a matter of experience, I had failed to find a case on record of any damage by lightning, within certain limits given below, when the conductor was destroyed by the discharge. The why and the wherefore of this did not concern me, though of course interesting as theoretical questions.

As no exception was cited at the meeting referred to, and as I could not elicit the citing of an exception through the publication of the article in *Science*, or of the article or abstracts of it in the several electrical journals of the country, I began in the issue of *Science* for June 19, 1891, the regular insertion, which was continued till Feb. 15, 1892, of the following: —

Query.

Can any reader of *Science* cite a case of lightning stroke in which the dissipation of a small conductor (one-sixteenth of an inch in diameter, say,) has failed to protect between two horizontal planes passing through its upper and lower ends respectively? Plenty of cases have been found which show that when the conductor is dissipated the building is not injured to the extent explained (for many of these see volumes of Philosophical Transactions at the time when lightning was attracting the attention of the Royal Society), but not an exception is yet known, although this query has been published far and wide among electricians.

This has also failed to bring out a single exception to what, so far as I know, is true, that by the destruction of a small conductor all else is saved to the extent named.

Let me describe here in Franklin's own words a typical case of protection furnished by a small conductor dissipated by the discharge.

Franklin, in a letter to Collinson read before the Royal Society, Dec. 18, 1755, describing the partial destruction by lightning of a church-tower at Newbury, Mass., wrote: "Near the bell was fixed an iron hammer to strike the hours; and from the tail of the hammer a wire went down through a small gimlet-hole in the floor that the bell stood upon, and through a second floor in like manner; then horizontally under and near the plastered ceiling of that second floor till it came near a plastered wall; then down by the side of that wall to a clock, which stood about twenty feet below the bell. The wire was not bigger than a common knitting-needle. The spire was split all to pieces by the lightning, and the parts flung in all directions over the square in which the church stood, so that nothing remained above the bell. The lighting passed between the hammer and the clock in the above mentioned wire, without hurting either of the floors, or having any effect upon them (except making the gimlet-holes, through which the wire passed, a little bigger), and without hurting the plastered wall, or any part of the building, so far as the aforesaid wire and the pendulum-wire of the clock extended; which latter wire was about the thickness of a goose-quill. From the end of the pendulum, down quite to the ground, the building was exceedingly rent and damaged. . . . No part of the aforementioned long, small wire, between the clock and the hammer, could be found, except about two inches that hung to the tail of the hammer, and about as much that was fastened to the clock; the rest being exploded, and its particles dissipated in smoke and air, as gunpowder is by common fire, and had only left a black, smutty track on the plastering, three or four inches broad, darkest in the middle, and fainter towards the edges, all along the ceiling, under which it passed, and down the wall."

There can be plenty of cases cited of the failure of a large conductor to protect, as is well known to all who have looked into the subject. Of course, all sorts of excuses have been offered for the failure of the ordinary rods, which have been well put by Oliver J. Lodge, F.R.S., who has investigated the electrical problems connected with lightning and lightning protection more than any-one else, and is a complete sceptic as to the efficiency of rods, who says that "when, in spite of all precautions, accidents still occurred; when it was found that from the best-constructed conductors flashes were apt to spit off in a senseless manner to gun-barrels and bell-ropes, and wire-fences and water-butts, — it was the custom to more or less ridicule and condemn either the proprietor or its erector, or both, and to hint that if only something different had been done,— say, for instance, if glass insulators had not been used, or if the rod had not been stapled too tightly into the wall, or if the rope had not been made of stranded wires, or if copper had been used instead of iron, or if the finials had been more sharply pointed, or if the earth-plate had been more deeply buried, or if the rainfall had not been so small, or if the testing of the conductor for resistance had been more recent, or if the wall to which the rod was fixed had been kept wet,— then the damage would not have happened. Every one of these excuses has been appealed to as an explanation of a failure; but because the easiest thing to abuse has always been the buried earth connection, that has come in for the most frequent blame, and has been held responsible for every accident not otherwise explicable."

This fact of the complete protection furnished by a dissipable conductor stands, therefore, uncontroverted. One very pleasant endorsement comes from Moses G. Farmer, the veteran electrician, who writes: "My experience and observations both confirm his [my] views."

I repeat, Can any one cite a case of failure, not any theoretical considerations *pro* or *con*, but an actual case of failure under the conditions and to the extent named?

N. D. C. Hodges.

874 Broadway, New York.

TOX-ALBUMIN DIPHTHERIA.[1]

IN a preliminary communication published in the Hospital Bulletin, No. 15,[2] we called attention to the histological changes in the organs of animals which had died of experimental diphtheria, following the inoculation of pure cultures of the bacillus diphtheriæ. Since then we have extended our investigations so as to include the study of the lesions produced by the inoculations of the toxic products of the diphtheria bacillus. This study virtually finishes the work we have undertaken, and it is hoped soon to publish our results in detail. However, in order to make our preliminary communication complete, we append this report: —

The toxic products of the diphtheria bacillus with which we have operated were obtained by filtering through a new and sterilized Chamberland filter the culture of the organisms in glycerine bouillon, several weeks old. The fluid so obtained was tested by means of cover-slips and inoculations on glycerine-agar, and proved to be sterile.

Guinea pigs were used for the experimental inoculations. The sterile culture fluid was introduced subcutaneously into the tissues of the belly wall by means of a Koch's syringe. The method pursued will be given in connection with the case of which the lesions are to be described. The guinea pig received on Dec. 10, 1891, one cubic centimetre of the filtrate. Not having succumbed on Dec. 14, it received two cubic centimetres more. The animal died on Jan. 5, 1892, the duration of life since the first inoculation having been three weeks and five days, and since the last three weeks and one day.

At the autopsy the vessels of the subcutaneous tissues were injected, and hemorrhage had taken place into the tissues of the axillary and inguinal regions. The subcutaneous tissues were moist, but there was no actual œdema present. Neither was there a visible area of localized inflammation; no microscopical examination was made of the seat of inoculation. The lymphatic glands of the axillary and inguinal regions were enlarged and reddened, the cervical glands were swollen, and the thyroid gland was greatly congested.

There was a considerable excess of clear fluid in the peritoneal cavity. Both layers of the peritoneum were reddened, the vessels of the visceral layer being especially injected. The spleen was enlarged to double the average size. It was mottled, and the white follicles were distinctly outlined against the red ground. The liver was dark in color, and contained much blood. On the surface a prominent yellowish-white area two millimetres in diameter, surrounded by a zone of hyperaemia, was observed. Smaller dot-like points of the same color and general appearance were seen elsewhere in the liver. The kidneys were congested and the cut surface was cloudy. The adrenal glands appeared normal, as did the mesenteric glands.

The pleural cavity did not contain such a marked excess of fluid. The pericardial sac, however, was distended with clear serum. Under the epicardium were many ecchymotic spots. The lungs exhibited areas of intense congestion, or actual hemorrhage into the tissues. The glands of the thorax were, perhaps, swollen.

The examination of the heart muscle by means of frozen sections showed it to be slightly fatty. The epithelium of the tubules of the kidney was extremely granular and much swollen, but not fatty. The liver was very fatty; the lighter areas and dots were seen to correspond to foci of dead liver cells, whose refractions were much greater than that of the normal cells.

Cultures were made from the blood and organs of the animal, and they remained sterile. Cover-slips also were examined and no organisms found.

The histological lesions observed in this case are identical with those described by us in connection with the inoculations of the living organisms. Lymphatic apparatus: In general, the changes are the same throughout. They are found in the greatest intensity in the glands of the axillary and inguinal regions, and less in the bronchial and cervical, mediastinal, and mesenteric glands. Yet these are considerably affected. The same fragmentation of nuclei affecting the lymph-nodes and sinuses is met with. These fragments exhibit the variety of form previously described by us, and they have the same affinity for coloring agents. Much of the nuclear detritus is free, but a part is contained within large pale cells. In the spleen there is a similar diffuse fragmentation of the nuclei of the spleen cells. Both the lymphoid cells of the follicles and the larger cells of the sinuses are affected. Like the lymphatic glands, some of the nuclear detritus is enclosed in large cells. Besides the destruction of cells in the spleen there is hemorrhage into the organ, or an extreme degree of congestion, so that the tissue elements are widely separated from one another. Nuclear figures occur in the lymph glands and spleen. In the former they are found among the fragmented cells.

Stained sections of the liver, especially those stained in methylene-blue and eosine, show the yellowish-white areas to be composed of hyaline, necrotic liver cells. The necrotic cells stain deeply in the eosine, and they are usually devoid of nuclei. They form, on the whole, more or less definite foci of hyaline cells into which leucocytes have wandered. The largest area was two millimetres in diameter, and the outlines of it were formed by hemorrhage into the tissues corresponding with the hyperæmic zone spoken of above. The cells in this focus have lost their nuclei and they are intensely refractive. Many of the dead cells have retained their individuality, and, indeed, their borders are more distinct than those of the normal cells. Others, however, tend to become fused together and to lose their individual cell outlines. Occasionally, outside the main focus of hyaline cells, single necrotic cells occur, which are surrounded by quite normal ones. Many leucocytes have wandered into this area of dead liver cells, and they are especially abundant at one place in the focus in which the hyaline cells are in process of disintegration. An exquisite nuclear fragmentation is to be observed throughout this area.

Should the focus just described be compared to many similar foci which occur in the livers of animals dead of inoculation with the bacilli themselves, it will be seen to contain more polynuclear leucocytes within it. The explanation of this fact would seem to depend somewhat on the inoculation-time, but more, probably, on the progression, or stage, of the necrotic process. Inoculation of the bacilli usually leads to death in a very short time, twenty-four to forty-eight hours. In this inoculation with the toxic products alone, the incubation period exceeded three weeks. On account of this, time has been allowed for the softening and disintegration of the dead cells, and leucocytes have been strongly attracted to these foci.

In the kidneys, besides the condition described in the frozen sections, a slight fragmentation of the nuclei of the tubular

[1] "The Histological Lesions Produced by the Tox-Albumin of Diphtheria," by Wm. H. Welch, M.D., professor of pathology, and Simon Flexner, M.D., fellow in pathology. From the Pathological Laboratory of the Johns Hopkins University and Hospital. Bulletin of the Johns Hopkins Hospital, No. 20, March, 1892.

[2] Abstract, Science, No. 457, November 6, 1891.

epithelium is encountered. The lungs exhibit areas of hemorrhage into the alveoli, and in many of these there has been a desquamation of the alveolar epithelium. Sometimes the desquamated epithelial cells are quite normal in appearance, while at others they have fragmented nuclei. The collections of lymphoid cells around the medium-sized and larger bronchi show, however, more cells, the nuclei of which have suffered in this way.

The blood-vessels of the tissues generally contain fewer leucocytes in this instance than in those cases in which the bacilli were introduced beneath the skin. By the latter method an intense local inflammatory process is provoked, associated with the emigration of large numbers of polynuclear leucocytes. In the former, in which the filtrate, free from organisms, is used for inoculation, the local process is reduced to *nil*, there is no emigration of leucocytes, and the disease is general from its inception. This difference is sufficient to account for the occurrence of leucocytosis in the one and its absence in the other case.

It may be considered as established now that the toxic products and not the bacilli themselves invade the tissues in diphtheria. This fact would at once suggest that the general lesions (those produced at a distance from the seat of inoculation in animals, and the situation of the local process in human beings) were the effects of the soluble poison diffused through the body. Hence, it was desirable to demonstrate this assumption experimentally; and it is not unimportant to know that the lesions in the tissues produced by bacilli and the toxic principle on the one hand, and by the toxic principle alone on the other, are in perfect correspondence with each other. And, moreover, it would seem not to be superfluous to emphasize the occurrence of definite focal lesions in the tissues of the body, produced by a soluble poison circulating in the blood.

DESCRIPTION OF A SUPPOSED NEW SPECIES OF STORERIA FROM FLORIDA, STORERIA VICTA.

THE species of *Storeria* here to be described as new was found in the alimentary canal of a specimen of *Elaps fulvius*, which was taken on the banks of the Oklawaha River, Florida, by one of my students, Mr. H. T. Mann. The *Storeria* had been swallowed head first, and had been somewhat digested anteriorly, but the hinder half or two-thirds of the body had undergone little change. Sufficient traces of the cephalic plates were left to show that the latter were those of the genus *Storeria*, the loreal being certainly absent. About twenty-five of the anterior ventral plates were missing, but the number of these could be determined from the vertebræ there exposed.

The dorsal scales are in fifteen rows. When the scales of the middle of the back are compared under the microscope carefully with those of a specimen of *Storeria dekayi* of the same size, the former are plainly of a greater proportional width. Whether or not this will hold true in all cases I can not, of course, say. The ventral plates number 146, counting from the angle of the jaw. There are 60 pairs of subcaudal scales. The anal plate is divided The total length of the specimen is 14 inches, of which 3 are tail.

The color is gray above, with a tinge of yellow. In the middle of the back are very faint indications of a clay colored band. This occupies the median three rows of scales. The next row of scales on each side is occupied by an indistinct dusky line and by a row of black specks. These lie distant from one another about the length of two scales. Lower down on the sides the color becomes paler, but another dusky streak is seen lying partly on the lower row of scales and partly on the out-ends of the ventral plates. The belly is pale yellow, with a row of small, but very distinct, black spots along each side. There is a single spot on each end of each ventral plate, lying about half-way from the middle line of the belly and the outer end of the plate. A few smaller, irregularly placed spots are also seen. The under surface of the tail is plain yellowish white. *Storeria dekayi* sometimes has black dots on the abdomen, but they are irregularly scattered, or at most do not form rows the whole length of the belly.

This species appears to differ from *Storeria dekayi* in the smaller number of dorsal scales (15 instead of 17), in the greater proportional width of the scales, in the somewhat greater number of ventral plates, and in the presence of the two rows of spots on the abdomen. As to the number of ventrals, Mr. Samuel Garman ("Serpents of N. A.," p. 31) states that they vary from 120 to 138. He mentions, however, a specimen from Jalapa, Mexico, which had 145 ventrals. It is possible that the animal which I here describe as new is a specimen of *S. dekayi* with a smaller number of scales than usual, but until there is other evidence of this, it seems better to regard it as different.

From *S. occipitomaculata* my specimen differs in having a considerably larger number of ventrals and subcaudals than have yet been attributed to that species, in the presence of the rows of ventral spots, and in size. The relations of the specimen appear to lie evidently with *S. dekayi*.

The oviducts of the specimen contained a dozen eggs, each somewhat more than a quarter of an inch in length. The coverings of the eggs are extremely thin, from which I infer that the animal brings forth its young alive. This is the case with *S. dekayi*, and probably with the other species of the genus.

The specimen here described will be deposited in the National Museum at Washington. O. P. HAY.

Irvington, Ind., April 2.

THE HIGHER EDUCATION OF THE DEAF.

THE following letter was recently addressed to President E. M. Gallaudet of the National College at Washington, by Mr. A. L. E. Crouter, principal of the Pennsylvania Institution for the Deaf and Dumb:

PRESIDENT E. M. GALLAUDET, PH.D., LL.D.

My Dear Sir: Since my return from the meeting of the Board of the American Association to Promote the Teaching of Speech to the Deaf, held in your city in January, my thoughts have frequently recurred to a matter of much interest to the association, and, to my mind, of vital importance to your college work, namely, the introduction of oral methods in the instruction of a portion, at least, of the young men and women who come to you for a higher education than the primary schools of the country are able to afford them.

And, in venturing to address you formally upon the subject, I beg you to believe that I am not impelled by any spirit of captious criticism, nor by any desire to intermeddle with the affairs of your excellent and well conducted school, but simply and solely to suggest for your consideration a step which I sincerely believe will, if put into effect, greatly promote and extend the usefulness of the college whose affairs you have so long and so ably directed.

As you are aware, Mr. Greenberger, at our meeting in Washington, brought up the question of oral instruction (recitations) for oral students at Kendall Green, maintaining that, in a school supported by the national government, equal educational advan-

[1] From the Silent World.

tages and privileges should be accorded to the orally taught deaf and to the manually taught deaf, pursuing oral methods in the education of the former, manual methods with the latter. In bringing up the subject, Mr. Greenberger disclaimed any unfriendly feeling towards the college, and I wish to do him the justice to state that he had no desire to embarrass you in your noble work, but, moved by a sense of justice, he felt that the time had come when the association should take a stand in favor of the higher oral education of the orally taught deaf of the country, in the college at Kendall Green if possible, if impossible, then outside in a separate school. Now, while the question was disposed of, for the time being at least, in a way that exhibited the kindliest feeling toward you and your college work, I feel that sooner or later it will have to be met and disposed of to the advantage of the college or to its disadvantage, strengthening it if an oral department be added, weakening it if, refused in what they believe to be just demands, the friends of higher oral instruction for the deaf establish a separate college for their higher education. The oral instruction of the deaf, whether wisely or unwisely, is unquestionably commanding increased public attention and public sympathy, and the college that seeks to provide the highest and best educational facilities for the deaf as a class should stand ready to meet every reasonable demand. The number of orally taught deaf is constantly increasing, they are seeking higher instruction than the primary schools afford, where shall they obtain it?

They hesitate, and object, and refuse when directed to Kendall Green, not because it is not a good school, nor because its professors are not competent men but because of a well-founded fear that that which they have spent much time and labor in gaining, namely, their speech and their ability to read speech, may be very seriously impaired. Shall this class of deaf-mutes come to Kendall Green to profit by instruction at the hands of its able and experienced professors, greatly strengthening the power and influence of the college, or shall they be driven to another school?

To me, interested as I am in the success of the only college for the deaf in the world, this is a most important question, and I believe it will receive the careful consideration that its importance demands at your hands. The formation of an oral department with the means you have at your command should not present any serious difficulties, nor prove seriously harrassing to your well-ordered college work. For material you would have the best from every school in the land, and for support you would have the sympathy and active influence of every friend of the deaf throughout the world.

A. L. E. Crouter.

March 5.

NOTES AND NEWS.

The faculty of Cornell University has been invited to send representatives to take part in the Tercentenary Festival of the University of Dublin, next summer, and has accepted, Professor Corson going as its representative. Dr. Thurston has received a personal invitation from the University of Dublin for the same occasion, and is expected, if he should be able to go, to remain in Dublin as the guest of Dr. Lucius O. Hutton of Fitzwilliam Place.

— The second number of 1892 of the Bulletin of the Ohio Experiment Station summarizes the experience of the station in the culture of mangolds and sugar beets. Mangolds have been grown on the station farm for ten or twelve years past, to serve as food for the dairy cows; twelve to fifteen tons per acre being an ordinary yield. The beets are eaten with great relish by the cows, they cause an increased flow of milk, and the milk is thought to be of a better quality. The milk from this dairy is sold direct to consumers, and these have claimed that they could tell when beet feeding began in the fall by the improved flavor of the milk. In 1891 a number of varieties of sugar beets were grown alongside the mangolds; it was found that the sugar beets were considerably less productive than the mangolds, yielding but seven to nine tons per acre, against twelve to twenty tons for the mangolds. The sugar beets, however, showed on analysis about six per cent of sugar, while the mangolds showed but three per cent. The labor-cost of producing an acre of beets is from thirty to forty dollars, as grown at the station, where they are planted in rows sufficiently wide to admit of horse culture. By planting in rows only half as far apart the crop might largely be increased, but the cost of cultivation would also be increased. In a bulletin issued a year ago by the Chemical Division of the United States Department of Agriculture, a table is given showing that the average cost of manufacture in 113 German beet-sugar factories in 1889–90 was nearly $3 per ton of beets. If it were possible to raise an average crop of fifteen tons per acre of sugar beets in Ohio at a cost of $30 per acre, or $2 per ton, or to manufacture them at a cost of $3 per ton, the total cost for production and manufacture would be $75 per acre. Such a crop would yield 1,800 pounds of sugar, at the rate shown by the station analysis, worth $72 at four cents per pound, thus leaving no margin whatever to either producer or manufacturer to cover the losses from bad seasons on the farm or in the factory. It is true the present bounty would afford this margin; but the bounty ends with 1895, unless renewed, and its future is very uncertain. Sugar beets grown in the dry climate and on the rich soils of Nebraska and Iowa show an average of about thirteen per cent sugar, or more than twice that found at the Ohio station, thus following the well-known law that the sugar beet reaches its highest development in northern latitudes. Beets grown in northern Ohio would probably show a higher per cent of sugar than has been found at the station, but it is extremely doubtful if the culture and manufacture of sugar beets can be made profitable in any part of Ohio in competition with the more favored regions of the North-west and of California, and the Experiment station would advise Ohio farmers to be very cautious about entering upon any large undertaking in sugar beet culture. There are probably spots in northern Ohio where spring wheat could be grown, and it is possible cotton might mature in sheltered coves in Lawrence County; but it would hardly be advisable for the farmers of either section to enter into competition with the spring wheat growers of the North-west or the cotton planters of the Gulf States.

— The Oriental History Society of Altenburg will celebrate in the autumn of 1892 the seventy-fifth anniversary of its establishment, and will take advantage of this opportunity to pay tribute to three of the honorary members of the Society, by the erection of a simple, worthy monument in the capital city of Altenburg. They are Christian Ludwig Brehm, his son, Alfred Brehm, and Professor Schlegel, who died at Leyden. The researches of these three men in zoology, and particularly in ornithology, are known, not only among their associates, but throughout the world, and deserve that their memory should be honored. A committee, consisting of Prince Moritz of Saxe-Altenburg; Professor Dr. Blasius, Braunschweig; Dir. Professor Flemming, Altenburg; Major A. v. Homeyer, Greifswald; Hugo Koehler, privy-councillor of commerce, Altenburg; Dr. Keopert, Altenburg; Professor Dr. Liebe, privy-councillor, Gera; Professor Dr. Pilling, Altenburg; Dr. Reichenow, Berlin; Dr. Rothe, privy-councillor of medicine, Altenburg; Chevalier von Tschusi zu Schmidhoffen, Halfein; Dr. Voretzsch, Altenburg; and Dr. Leverkuhn, Munich, under the patronage of His Highness, Prince Moritz of Saxe-Altenburg, also an honorary member of the society, solicits contributions from the friends of these eminent scientists, for the purpose of aiding in the erection of the proposed memorial. It is respectfully requested that contributions be forwarded to Hugo Koehler, privy-councillor of commerce, in Altenburg, and that inquiries and letters be addressed to Dr. Koepert, in Altenburg.

— Mr. R. H Scott delivered a lecture at the Royal Institution on March 18, on a subject of much importance to England, viz.: "Atlantic Weather and its Connection with British Weather." He pointed out, says *Nature*, that less than a quarter of a century ago, before synchronous charts were in vogue, it would have been impossible to have traced a storm across America and the Atlantic to Britain's coasts; but this can now be done with considerable certainty. The broad principles which govern the weather system of the Atlantic were shown on two diagrams exhibiting the mean pressure, and the regions of greatest disturbance of temperature, on the globe in our winter. The latter chart showed that, at that season, the relatively warmest district is near Iceland; and the barometer chart showed that close to the same region the barometer is lowest. The reasons of these relations, which involve the first principles of modern weather knowledge, were fully explained. The more northern part of the Atlantic area interests us the most. The whole region from 40° to 70° north is constantly visited by cyclonic depressions, and in order to throw some light on the origin and history of these depressions, and of the storms which they at times bring with them, various institutions have published daily maps of the weather in the Atlantic. The most complete of these maps were published by the Meteorological Office for thirteen months, commencing with August, 1882. The last twelve of these months have been carefully examined, and show no less than 264 depressions in various parts of the ocean. Of these, out of 62 which originated south of 40° north, only 16 had sufficient energy in them to cross the meridian of Greenwich, while out of 22 which originated further south only 11 crossed the Atlantic, and these were not all felt as actual storms in England. The practical outcome of obtaining telegrams from America has not been satisfactory, but this failure has probably been mainly due to the fact that the reports "have been neither numerous nor full enough." This accurately represents the case at the present time; but we hope it is not too much to expect that, with our present knowledge of the paths taken by depressions with regard to areas of high pressure, some further advance may shortly be made in predicting storms by means of more numerous and fuller telegraphic reports both from outward and homeward bound ships.

— At the British Institution of Electrical Engineers recently an interesting paper, illustrated by experiments, was read by Professor D. E. Hughes, F.R.S., on the value of oil as an insulator of electricity, especially for currents of high potential and frequency. Professor Hughes was led to recognize the merits and to suggest the use of oil as early as 1858, after the failure of the first Transatlantic cable, according to *Engineering*. It then appeared to him that a fluid insulator with self-correcting properties would be preferable to a solid insulator, such as gutta percha or india-rubber; which, when once punctured by a spark, cannot close the wound like oil, and thus renders the entire circuit useless until the fault is removed. Professor Hughes made many experiments on various oils at that time, and embodied his results in a British patent, dated Jan. 11, 1859, for "an improved mode of insulating electrical conducting wires." The oil he had found most serviceable was resin oil, which has an extraordinarily high resistance and is somewhat viscid. He proposed to contain it in tubes of gutta-percha or metal, through which the conductors, coated either with a thin layer of gutta-percha or merely covered with fibrous material, would run. The inventor tried for two years to get English electricians to adopt his method, but in vain; and, having to proceed to the Continent, he was obliged to abandon it. The late Mr. David Brooks of Philadelphia subsequently introduced it in America, with great success and profit to himself, for insulating underground telegraph wires. Oil is now used for insulating transformers, and it promises to be employed in a great many other ways.

— At the meeting of the Belgian Academy of Sciences on March 6, Professor Spring announced, as we learn from *Nature*, that the late Professor Stas had left, in an almost completed condition, a long and important memoir describing the results of several further stoichiometrical investigations. It is entitled "Silver," and will forthwith be edited, presumably by Dr. Spring, and published. It may be remembered that, after the publication of Professor Stas's classical memoir upon the preparation of absolutely pure silver and the atomic weight of that metal, doubts were thrown by Professor Dumas on the validity of the work on the ground that the silver employed was not free from occluded atmospheric gases. Moreover, Professor Dumas expressed doubts as to the bearing of the work upon the celebrated hypothesis of Prout, according to which the atomic weights of all the other elements are supposed to be multiples of that of hydrogen. For, if silver possessed the atomic weight attributed to it by Professor Stas, the atomic weight of oxygen became 15.96 and not the whole number 16, and consequently Prout's hypothesis in its original form would be negatived. In order to set these doubts at rest, and to leave his work in a perfected condition, Professor Stas prepared a quantity of silver with such extreme precautions that he succeeded in obtaining it entirely free from occluded gases, and from even the minutest traces of the materials of the vessels employed. So perfect is the purity of this silver that even when heated to the temperature of the melting-point of iridium not a trace of sodium can be detected in the spectrum of the vapor. With this silver he repeated his former determinations of the atomic weight of the metal, and it is satisfactory to learn that the final number obtained is, as Professor Stas himself expected it would be, identical with that formerly obtained. Hence the objection of Professor Dumas cannot longer be entertained, and the atomic weight of oxygen would indeed appear to be 15 96 and not 16, for the numbers obtained by Professor Stas agree so remarkably that an error of four-hundredths of a unit would apparently be out of the question. In addition to this important memoir, Professor Stas has also left the data of a series of twelve separate determinations of the stoichiometric relation of silver to potassium chloride, the materials for which were the pure silver just described, and a specimen of potassium chloride, also prepared with a care and precaution quite in keeping with the rest of the work of the great analysist. The results of these determinations are described by Professor Spring as agreeing in a most wonderful manner, and will afford another valuable base to which the atomic weights of many other elements may be referred. Besides these two memoirs, a third is mentioned by Professor Spring, relating to the spectra of several metals which Professor Stas obtained in the purest state in which these metals have ever probably been seen. The whole of these memoirs, consisting of about fifteen hundred pages of manuscript, it is intended to publish forthwith in three separate treatises.

— Although preparations of lettuce have from very early times had a reputation in medicine for their soporific properties, the narcotic constituent of the plant has never been ascertained with any certainty. Various neutral, fatty, and waxy bodies separated from the milky sap of different species of Lactuca have been from time to time described as compounds of medicinal value, but on the other hand it has been denied that the dried milk-sap, lactucarium, in spite of its narcotic odor, possesses any sedative action, and in fact this preparation is no longer officinal in England or the United States. It is therefore interesting to learn in a communication from the Research Laboratory of the Pharmaceutical Society, read recently before the Clinical Society, that Mr. T. S. Dymond has established beyond doubt the presence of hyoscyamine, the principal alkaloid of belladonna and henbane, not only in the cabbage and Cos varieties of the common lettuce, L. sativa, but also in the wild lettuce, L. virosa. The amount in the young plants is certainly very minute, but in the officinal green extract, which, according to the directions of the "British Pharmacopœia," is to be prepared from the flowering herb of L. virosa, the mydriatic alkaloid occurs to the extent of 0.02 per cent.

— In a communication to the Paris Academie des Science, M. Le Chatelier states that by means of his pyrometer he has discovered that the temperatures which occur in melting steel and in other industrial operations have been overestimated. These exaggerations, we learn from *Engineering*, the author attributes to several causes. When estimates of temperature disagree there is a natural tendency to adopt the highest, because there is an instinctive desire to establish some sort of proportionality between the light emitted from a heated body, the amount of fuel required, and the temperature. But the fact is that both the amount of light emitted from a body, and the quantity of fuel required to heat it, increase much more rapidly than the temperature. Moreover, the calorimetric method has been that most frequently adopted for determining high temperatures. In this the assumption is made that the specific heat of the iron rods or balls used is constant, which is inaccurate. In the case of the flame of the Bessemer converter Mr. Langley has fixed the temperature of the issuing flame at 2,000° C., because platinum appears to melt rapidly in it. Mr. Chatelier has, however, found that platinum does not fuse in the flame, but only appears to do so because it alloys itself with drops of molten steel carried over by the blast.

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CURRENT NOTES ON ANTHROPOLOGY. —III.

[*Edited by D. G. Brinton, M.D., LL.D.*]

An International Anthropometric Scheme.

DR. R. COLLIGNON of the French Army is well known as one of the most active students of anthropology in France. His researches on the tribes of North Africa are classical. He has just issued a "Projet d'Entente Internationale pour arrêter un Programme commun de Recherches Anthropologiques," which should attract the earnest attention and co-operation of followers of this science the world over.

Without entering into the other details of his plan, those relating to the actual measurements desired may be here stated. In all cases there should be noted the height, the color of the eyes, as either light, dark, or intermediary; color of the hair, as either red, blond, intermediate, brown, or black; line of the nose, as either convex, straight, or concave. In addition to these, on forty subjects, the two factors of the nasal index should be carefully noted; finally, on twenty of these the following head measurements: maximum antero-posterior diameter, maximum transverse diameter, maximum bizygomatic diameter, total height of head.

Of course, the value of such statistics for comparison will depend a good deal on the operative methods employed. Dr. Collignon explains these with great care; and I would urge all who would like to aid in this admirable project for international scientific work to address him for particulars, as follows, Dr. Collignon, 42 Rue de la Paix, Cherbourg (manche), France.

Embryonic Causes of Variations in Vertebrates.

The fundamental question in anthropology is that of the causes which have led to the differences in the races of men. Hitherto most writers have been content with surface generalizations about "environment" and "heredity." The disciples of Spencer have rung the changes on these with little positive profit. We have no knowledge what heredity really is, and "environment" has borne more than its share of causality.

A real step in advance has been taken by Dr. Dareste, in his work on "Teratogeny," or the artificial production of monsters. He shows conclusively that monsters or monstrosities are not the result of pathological changes in the embryo, as has hitherto been supposed, but are modifications of the processes of organic evolution, precisely analogous to those which bring about the differences which distinguish individuals and races in mankind. This can be proved experimentally in oviparous animals, the domestic fowl, for instance. By developing the chick in an artificial incubator and subjecting the egg to unusual conditions, such as shaking it from time to time, varnishing it, exposing it to rapid changes of temperature, etc., we can produce monstrosities in all points analogous to those in man.

The changes take place in the earliest epochs of embryonic life and are in two directions: 1, arrest of development; 2, union of homologous parts. The former assures the permanence of an embryonic condition, the latter produces the phenomenon of double monsters. By tracing the conditions which yield these exaggerations, we may distinctly perceive the causes of many of the physical peculiarities of man.

Application of Psychological Research to Anthropology.

Experimental psychology is a comparatively new realm of research, and we may confidently expect from it most valuable aid in defining the differences between the races of men. Its main object may be said to be the measurement of the relative rapidity, intensity, and persistence of mental actions. This means that it endeavors to discover material gauges and mathematical formulas for the sensory, motor, and intellectual processes. Think what this involves! Nothing less than that we shall be able to measure the mental abilities of a man as we do his height and girth!

Though this goal is probably theoretical, as the individual generally eludes averages, these are true for the mass, and we may be sure that a series of observations on, say twenty, pure adult types of the several races would yield results markedly different and highly significant. The points to be examined are such as these: the rate of muscular movement, rapidity of nervous impulse, transmission of motor and sensory stimuli, race-differences in reaction-times, sensation-areas, differences in estimating weights, judgment of the passage of time, sensibility to pain, the rate of forgetting, etc. With the excellent psychological laboratories now in operation at several of our leading universities, these comparative observations could readily be made, and they certainly promise most important results.

Curious Testimony to the Value of the Nasal Index.

In 1882 the British Government began an ethnographic and anthropometric inquiry into the native races of India. The results, which are now nearly ready for publication, will fill four bulky volumes, and will contain a mass of most valuable material for the study of these interesting peoples. A glimpse of some of them is presented in an article in the last volume of the *Journal of the Anthropological Institute*, by Mr. H. H. Risley of the Bengal Civil Service. One of the most noteworthy is the conclusion that there are really no physical differences between the Kols and the Dravidian tribes, in spite of the radical diversity of their languages. Neither of them discloses any Mongoloid affinities, though a number of tribes in northern and eastern Bengal are clearly akin to that great Asian race.

But the most curious statistics are those relating to the nasal indices of the tribes examined. They corroborate the high value of this physical element in racial anatomy. The nasal index is found in India in two widely distinct types; the one platyrhine to a degree closely approaching the negro (88–95), the other leptorhine about in the same proportion as in western Europe (67–72). These indices bear a constant relation to the order of social precedence, to the distinctions of caste, and to the organization of the family. "It may be laid down as a working hypothesis, if not as an absolute law, that the social position of a caste varies inversely as its nasal index." Everywhere the narrow-nosed Brahmin is at the top, the broad-nosed Pariah at the bottom. Wherever there is a high index, — above 80, — we find a low social position and the totemic sub-division of the tribe; wherever the index is low, — below 75, — we are equally sure to meet high rank and an eponymous family system.

Incidentally it may be added that these investigations bear out the ancient Indian traditions that the Aryan nations of India entered the peninsula from the north-west, and destroyed or subjugated the ancestors of the dark, flat-nosed Kols. the "snub-nosed blacks," often referred to in the ancient Vedic war-songs.

OSTEOLOGICAL NOTES.

IN previous papers (*Science*, Vol. xvi., p.332, Vol. xvii., p. 117, Vol. xviii., p. 53) we have assumed that the modifications presented by the jugal arch in the Mammalia are due to the various influences derived from use or disuse, correlated necessarily with the habits and environment of the animal. In no order is the specalization of the arch, under the influences of natural selection, more clearly exhibited than in the Insectivora.

Adopting the classification of the highest authorities, and notably that of Dr. Dobson, this order may be divided into two sub-orders, first, Dermoptera, embracing only one species — Galeopithecus volaus — and, second, Insectivora Vera, which comprehends all the remaining families. This second sub-order may be divided in turn into two groups. In the first, — including the families. Tupaidœ, Macroscelidœ, Erinaceidœ, Talpidœ, and Soricidœ, — the true molars have W-shaped crowns. In the second group, including the Centetidœ, Solenodontidœ, Potamogalidœ, and Chrysochloridœ, these same teeth have V-shaped crowns.

Accepting the above classification, the Insectivora, so far as concerns the jugal arch, may be brought into three groups.

1. Those in which the arch is complete and well developed, comprising the Tupaidœ, Macroscelidœ, Rhynchocyonidœ, Galeopithecidœ.

2. Those in which the arch is complete but more or less feebly developed, comprising the Erinaceidœ, Talpidœ, Chrysochloridœ.

3. Those in which the arch is partially or wholly deficient, comprising the Centetidœ, Potamogalidœ, Solenodontidœ, Soricidœ.

The Tupaia (Squirrel-shrew) may be taken as a typical form of the first group. The jugal arch is well developed, a post-orbital process from the frontal meeting a corresponding one from the malar, thus forming a complete bony orbital ring. The malar has a large longitudinal oval vacuity, which, although unique in this case, when taken with similar vacuities in the palate of this genus, as also in some of the other Insectivora, points unmistakably to the Marsupilia. The horizontal curvature of the arch is sufficient to counteract any inherent weakness due to the vertical curvature with its convexity downwards. The temporal fossa is moderately extended, while the coronoid surface of the mandible presents a large backward projecting surface rising high above the transversely produced condyle.

In the second group, where the arch although complete is for the most part weak, the cranium presents marked modifications. In Erinaceus and Gymnura the arch is formed mostly by the processes of the Squamosal and maxilla which join, while the molar is very small and occupies in a splint-like form the outer and under sides of the centre of the arch. There are no traces of any post-orbital processes. The temporal fossa is deep and extended, while additional surface is afforded for the temporal muscle by the prominence of the sagittal and occipital crests. The ascending ramus of the mandible with its broad concave coronoid surface and the development of the pterygoid fossæ denote increased masticatory powers, in spite of the apparent weakness of the buttress.

In the Talpidœ, certainly in all of the truly fossorial of the family, the jugal arch is slender and exhibits no distinct malar bone, no occipital or sagittal crests, and no post-orbital processes. The mandible is long and the vertical portion presenting a moderately extended coronoid surface with a small transverse condyle. The infra-orbital foramen is of great size, being a very slender osseous arch which serves for the transmission of the large infra-orbital branch of the trifacial, which affords the necessary supply of sensory nerves to the muzzle.

In the Chrysochloridœ (Golden moles), which in the general shape of the skull present modifications different from all other Insectivora, the jugal arch is in some species so expanded vertically, that, as Dr. Dobson remarks, "their upper margins rise above the level of the cranium giving additional origin to the large temporal muscles." There is no post-orbital process given off either by the frontal or zygomatic arch. As regards the mandible, the coronoid process is little elevated and in some species is nearly level with the transversely extended condyle.

In the third group the arch is incomplete, and in one instance, at least, may be described as entirely absent. In the Centetidœ, the skull is long and narrow, and marked by largely developed occipital and sagittal crests which serve as attachments for the muscles of temporal origin. The zygomatic processes of the maxilla and squamosal are very short and rudimentary, while the malar is entirely absent. The temporal fossæ are very large, and the skull retains nearly the same width at their anterior and posterior regions. There is not a trace of a post-orbital process. The infra-orbital foramen is circular, and capacious. There are no pterygoid fossæ. The coronoid process of the mandible is largely deloped, its inner surface being concave, and its outer surface flattened. The condyle is small and circular, while the glenoid surface is transversely concave.

The other families of this group with the exception of the Soricidœ agree with the Centetidœ in the modifications of the skull that have been described. In the Soricidœ the cranium is broadest just behind the glenoid surfaces. There is no jugal arch and no trace of a post-orbital process. Frequently there is present a strongly marked lambdoidal ridge as well as a sagittal crest. There is no pterygoid fossa, but very large vacuities exist on each side of the basis cranii.

The mandible resembles that of the Talpidœ, although the horizontal ramus is shorter, while the ascending one "presents a very large and singularly deep excavation upon its internal surface quite characteristic of the genus." The articular surface of the condyle looks backwards instead of upwards. The angle of the jaw is elongated and thin.

The infra-orbital is large and bounded posteriorly by an osseous bar.

It will thus be seen that, in those families of higher forms which compose the first group, the jugal arch presents a typical formation.

In the second group, the slight modifications indicative of weakness, to whatever cause they may be assigned, are amply recompensed by the presence of cranial crests for increased muscular insertion.

More or less disuse, as the result of the loss of masticatory power, which is not needed, has so modified the arch in the last group that it has become much reduced, and in some cases has entirely disappeared. D. D. SLADE.

Cambridge, April, 1892.

ATTEMPTED EXTERMINATION OF THE POCKET GOPHER, GEOMYS BURSARIUS.

THE ravages of the pocket gopher extended very generally throughout the State of Iowa, but came under my own personal notice in the rich and fertile farm lands of Poweshiek County and surroundings. The annual loss they occasioned became a matter of such serious moment to the farmers of this county that on Jan. 8, 1890, an unusually liberal measure was voted by the board of supervisors, to the effect that "a bounty of ten cents a head be paid on gopher scalps taken in Poweshiek County, subject to the same laws and conditions that pertain to the payment of bounties on wolf scalps, and pockets must be produced in each case before the claimant will be entitled to the bounty."

These concealed little pests not only feed on surrounding vegetation, but, what is worse on the whole, choke it out by the innumerable mounds of earth heaped up by them everywhere.

I have seen fields which were literally black with gopher hills, and, if rooting swine can be said to upturn a field, so can the gopher. Besides, the loss by accidents to machinery and animals occasioned by striking against the gopher hills, or by sinking into their runs or holes, is very considerable. So while it is not to be marvelled at that some concerted action should be taken towards the extermination of such a pest, yet the high price paid for the experiment must excite some comment.

Taking into account the liberal bounty offered, the universal prevalence of gophers in countless numbers, and the fact that their capture was attended with but little labor, and only trifling cost, it can readily be seen how trapping by men, as well as boys, was at once tremendously stimulated.

It actually became a lucrative employment, at which the trappers spent their time in whole or in part for practically the entire year. The trapping began as early as February, and continued as late in the fall as December; the result of it all being that the incredible number of 140,000 was trapped and paid for in Poweshiek County during eleven months of the year ending December, 1890. The gopher pockets were taken instead of their scalps, and the price paid for 140,000 pockets by one county amounted to $14,000. As skill comes with experience, and as the great gopher populace of the county was but slightly thinned out, it was my judgment and that of others, that the catch of 1891 would considerably exceed that of 1890; some estimating the number that would be trapped as high as 200,000.

Accordingly the probable price which the county would have to lavish on gopher bounties bade fair to reach proportions that might bankrupt an ordinary county. While these facts were forcibly borne in on all taxpayers, yet the farmers were willingly taxed, even adding to the bounty in many cases to encourage trapping on their own lands, and stoutly defended the measure in opposition to the citizens of towns and villages who very unwillingly submitted to a taxation that seemed to them to discriminate between town and country rodents, believing that it was quite as fair and reasonable to apply the tax to the extermination of town rats as to field gophers.

An attempt to change the law failed, owing to the farmers' support, but in the winter of 1891 a resolution was passed reducing the bounty to five cents and requiring the claimants to present the fore legs instead of the pockets.

As a direct result of the reduced bounty, rather than a result of diminished gophers, the catch for the year ending December, 1891, was but 18,000, and of these no doubt a part was trapped in 1890. Trapping began in April and ended in December.

The gopher is a prolific rodent, and it seems almost absurd to believe that in a county where they probably number millions that their ranks have been noticeably thinned or their ravages diminished. The most sanguine supporters of the gopher bounty allowed not less than five years for their hoped-for extermination.

Taking into account their present numbers, their prolific natures, and underground habits, the attempt to oust them once for all seems almost a ridiculous undertaking. But what renders the present errand particularly bootless is the gopher at large in surrounding counties where no bounty is offered for their capture. The most persistent concerted action on the part of all the counties, while it might check the pestiferous gopher, could scarcely expect to destroy it; much less can an isolated county like Poweshiek, in the very heart of a gopher paradise, expect to reach that unattainable end.

Among the interesting nuts to crack offered the bounty supporters are a few considerations like the following.

As the gophers are thinned out in Poweshiek to the point where trapping is less profitable than in adjoining counties, the elastic consciences which some trappers are said to have will suffer them to trap outside and sell to the more liberal county, in spite of the binding oath which they must take.

But another absurd temptation was placed in the way of the faltering trapper. He could, in Iowa County, present to the county auditor the fore-legs of the gopher he had trapped, and draw his bounty where fore-legs were equivalents of scalps, and by crossing the line he could present the pockets of the self-same abused gopher and draw from the Poweshiek treasury an additional bounty on their pockets, thus making the poor gopher do him double duty. It is a known fact that all have not been slow in rising to their opportunities and drawing double bounty on the unfortunate victims of the trap.

In trapping gophers, it is the common practice to dig down and bury ordinary steel traps in their runs, and to visit these at stated intervals. The traps are not bated.

Among the gophers caught albinos are met with occasionally. During the fall of 1890 there were brought to me several gophers with white pelage — a dirty white — looking like a winter coat.

If albinos, their eyes were not pink, which suggested the possibility of an overlooked variety. From Mr. F. W. Porter, the auditor of Poweshiek County, who has furnished me many facts and figures, I learn that trappers speak of a white variety, counted by them particularly wary and hard to catch.

One caught in Grinnell was marked with hinder parts white and fore parts brown.

To those who have not seen the pocket gopher, it may be well to state that they are a small rodent of about the same color as, and perhaps a shade larger than, the domestic rat.

They have no external ears, have small bead-like eyes, a short tail, and powerful fore-legs, armed with strong claws for digging; and, what is very characteristic, they have large extensible cheek pouches or pockets. The presence of the gopher is made known to you by its mounds of earth, about the size of large ant-hills, rather than by its own presence, for it is rarely indeed that they are seen.

ERWIN H. BARBOUR.

University of Nebraska.

WIND-STORMS AND TREES.

Two very severe wind-storms have recently swept over Iowa which injured trees of all kinds, but especially some of the conifers. I have no record of the velocity of the wind in the storm of several weeks ago. It was less severe, however, than the one of last Friday. According to the weather office observations as reported in the *Iowa State Register* of April 2, the maximum speed was sixty-four miles an hour at 2 P.M. in Des Moines, Iowa. The gale started at daybreak, "By 11 the wind had reached an average velocity of fifty miles an hour, and it was approaching the danger-point. It kept gradually increasing until 2 P.M., when the wind-gauge at the top of the Federal building swung around to an average velocity of sixty-four, with sudden flaws above the 100-point." The weather observer, Mr. Schaffer, states that at the period of its greatest velocity the amount of pressure thrown against houses, glass, etc., was fifty pounds per square foot. The wind on Friday came from the south-west, and later shifted to the west. The severe wind-storm of several weeks ago came from the north. As usual in storms of this kind old and poorer branches fell readily, and trees suffered severely in consequence of the injury because of the many open wounds. I shall give a few illustrations how different trees were affected. On the college grounds, there are cultivated a large number of European as well as native trees. A few old trees were blown down, but these were partly decayed in the interior. Both gales seem to have been hard on some of the conifers. In some cases the ground was strewn with green leaves and short branches. In point of greatest injury Norway spruce (*Picea excelsa*) stands first. The branches broken off varied from one to six years' growth, mostly two and three years. It is also noticeable that many of the branches did not break at the beginning of the year's growth but in the middle. In many cases the branches are stripped of their leaves in the direction of the wind, — south, west, and north sides of the tree. The Scotch pine (*Pinus sylvestris*) is also affected, but in this case branches only, as a rule, were severed from the plant. The branches vary from one to six years' growth, occasionally more, but mostly within this limit. The same tendency to snap off in the middle of the year's growth may be observed. Few leaves were blown off.

Black spruce (*Picea nigra*) stands next. Some branches and leaves were broken off, though not nearly as many as in the other species.

White spruce (*Picea alba*) was also affected, but it seems able to stand the severity of the wind much better than the Norway spruce and Scotch pine. It is followed closely by the Hemlock (*Abies Canadensis*),—injury mostly confined to the leaves. There is only a single tree on the ground, which grows in a somewhat less exposed place than the white and Norway spruce, so that it may not be a fair test.

Red, or Norway pine (*Pinus resinosa*), some branches blown off and but few leaves. White pine (*Pinus strobus*), few leaves, a number of branches.

Balsam Fir (*Abies balsamea*) has suffered less than any of the above, a few branches were blown off.

Austrian pine (*Pinus Austriaca*) and Dwarf Mountain pine (*P. pumilio*) have lost few leaves and branches The red cedar (*Juniperus Virginiana*) should be classed with it. An occasional branch of *Larix europœa* and *L. laricium* may be found.

On the whole, the deciduous trees have fared better than the evergreens. Some species of willows (*Salix*) have lost many branches. The cottonwood (*Populus monilifera*) and soft maple (*Acer saccharinum*) have lost some branches. Honey locust (*Gleditschia triacanthes*, hackberry (*Celtis occidentalis*), hard maple (*Acer barbatum*), green ash (*Fraxinus viridis*), *Cratœgus punctata* have not suffered.

L. H. PAMMEL.

Iowa Agricultural College, Ames.

RUSSIAN SUNFLOWER INDUSTRY.

THE sunflower, as a garden plant, has been known all over Russia for many years, but only in certain districts has it been cultivated on a large scale as an industry. The first cultivation of sunflower seed for commercial purposes began, says the United States Consul General, at St. Petersburg, in 1842, in the village of Alexeievka, in the district of Berutchinsk, government of Voronezh, by a farmer who was the first to obtain oil from the seed. This farmer soon found many followers, and the village of Alexeievka soon became the centre of the new industry. The government of Voronezh is even now the chief district in European Russia for the growing of the sunflower. Besides the district of Berutchinsk, this plant is cultivated on a large scale in the districts of Novokhopersk, Ostrogoshk, Bobroosk, Valouisk and Korotoiaks. From the government of Voronezh the cultivation of sunflowers spread to the adjacent governments of Tamboo and Saratov, where there are large fields cultivated with this plant, particularly in the latter government. The people of the province of the Don and the governments of Simbersk and Samara are more or less engaged in this trade, in fact in the entire south east of Russia the sunflower furnishes a prominent product of the farm. Two kinds of sunflower are grown in Russia — one with small seeds, used for the production of oil, and the other with larger seeds, consumed by the people in enormous quantities as dainties. In the district where the seed is cultivated on a large scale, the plant has been continually grown on the same soil for many years in succession, thus producing a special disease of the plant. The sunflower seed is used principally for obtaining sunflower oil, which, owing to its nutritious qualities, purity, and agreeable flavor, has superseded all other vegetable oils in many parts of the country. In general, the cultivation of the sunflower in Russia is considered to be very profitable. At the average yield of 1,350 pounds to the acre, and at the average price of ¾d. a pound, the farmer receives an income of about £4 an acre, and this income can be increased in those districts where the grower himself engaged in producing the oil from the seed. The substance remaining from the oil manufacture, or sunflower cakes, being used as cattle food, is also a valuable product. These cakes, however, have a comparatively small demand in Russia, but are largely exported to foreign countries, principally to Germany and England. The government of Saratov, for instance, exports about 2,000,000 pounds of sunflower cakes to different countries, where a further quantity of oil is extracted from them before being used for cattle food. The sunflower shells being used for heating purposes, form an article of trade in several districts. The seed-cups are not wasted, but are used as food for sheep. The peasants in the government of Tambov are increasing the cultivation of the sunflower owing to the following reasons. There is a steadily increasing demand at home and abroad for the seed, thus making the industry a profitable one, especially as Russia is the chief source of supply. As above mentioned, the sunflower is cultivated principally for the oil. If the cultivation is made with care, and if proper precautions are taken in drying, cleaning, and pressing, sunflower oil is equal to the French table oil in color, flavor, and taste. At first sunflower oil did not meet with public favor in Russia, but later on, owing to its good qualities and cheapness, it took the place of the oil of poppy seed; but for a long time hemp-seed oil competed with it, owing to the fact that the lower classes, who for many years had used the hemp-seed oil in the preparation of various dishes, and who had learnt to relish it, were not disposed to give it up. Now, however, public opinion has changed, and sunflower oil is preferred by the masses to all other table oils in Russia. The process of oil-making is as follows. The seed being brought to the oil mill, is thoroughly cleaned and sorted. They are passed under millstones, specially prepared for the purpose, in order to release the seed from the shells. After this the seed is properly dusted and put under a press, and, later on, into a mixer, where the seed is turned into a compact mass very much like paste, which passes into vessels heated by steam. From these vessels the paste is taken out and wrapped in a thin web, made of camel hair, and put under a press, by which the oil is squeezed out and conducted by pipes into tanks. The total number of oil mills in Russia was, according to the last account, 104. From this number 85 were applied solely to obtaining sunflower oil. In 24 of these mills steam is used, and in others only manual power. The largest mill is at Saratov, and it produces 1,500,000 pounds of oil annually. There are two kinds of oil obtained from the sunflower seeds. The better kind is sweet, and more expensive, the inferior having a bitter taste. The difference in price of these two quatities is about one halfpenny a pound. The oil remaining from the oil production or the waste, and not used as food, is applied exclusively to certain industries. The sunflower stalks, gathered from the fields, and dried in piles, have entirely replaced firewood; in fact, these stalks are preferred even to pine-wood, producing a quick and hot-flame fire. About 2,000 pounds of such firewood are gathered from an acre of land, thus adding a great boon to a district where wood is scarce. Sunflower shells are also used for heating purposes, not only in private houses, but in large factories as well. They are burned in ovens specially prepared for their consumption. The ashes of the sunflower contain a large percentage of potassium. The experiments of Hermbstedt have proved that 1,000 pounds of dried stalks yield 57.2 pounds of ash; and from 1,000 pounds of ash are obtained 349 pounds of the best potassium. As a food for cattle, sunflower cakes are looked upon as the best in Russia; they are considered better even than hemp or rape-seed cakes. According to chemical analyses, the sunflower cakes from the Government of Saratov contain: Azotic substances, 42.31 per cent; oil, 14.7 per cent, and ashes, 5.12 per cent. The dried seed-cups, if ground, are used in many districts as food for cattle, and particularly for sheep, with great success.

FLEXIBLE TUBING.[1]

AT a meeting of the London Society of Arts, held on Wednesday evening, March 23, Mr. G. R. Redgrave gave an interesting lecture upon the subject of flexible tubing. After a passing reference to rubber tubing, leather hose, and similar ancient forms of this tubing, he proceeded to describe the flexible metallic tubes which had been invented by Mr. E. Levavasseur. This gentleman is, it appears, a jeweller, and many years ago invented necklaces and bracelets made out of tubes produced by coiling together two strips of gold and silver. One of these strips had a channel section, and the other, of a semicircular section, served to unite adjacent coils of the channel section together, and form a complete tube. About six years ago the idea occurred to him that flexible tubes could be formed on the same principle out of strips of metal, the tightness of the joints being secured by a strip of rubber. Many different forms of section for the strip were tried, the first being a sort of double channel section with which a great amount of flexibility was secured, but the heavy strain thrown on the rubber caused it to wear rapidly. In a later form the strip used was somewhat of the shape of a figure 8, which gave a more perfect interlock, so that the disruption of the tube could only be effected by the strips splitting under the strain. The rubber, too, was better protected and there was less chance of its working out. But this tube was less flexible than its predecessor, and suffered from the same defect in that the tightness of the joint depended upon a perishable material. Other forms of strips were tried in succession, and finally one has been arrived at in which a perfectly tight joint is secured without the use of any packing whatever, metallic surfaces only being in contact. The tubes thus formed are found to be tight under both high and low pressures, the form of the strip being such that the greater the pressure the tighter the joint. These tubes have been successfully used for conveying petroleum oil gas at a pressure of 300 pounds per square inch, and a small tube $\frac{3}{8}$-inch in diameter formed out of a strip 14 millimetres wide and .6 of a millimetre thick, only yielded at a pressure of 2,000 pounds per square inch. The tubes, moreover, will stand a partial vacuum. Their flexibility is such that a $\frac{5}{16}$-inch tube can be bent to a radius of 4 inches, and a one-inch tube to one of 6 inches. The tubes, moreover, can be trodden on with impunity, and would almost stand a cart being driven over them, a load of 18 hundred-weight on one inch of bearing surface being required to compress a 1 inch tube to an oval section. The difficulties of manufacture have been considerable, long flexible strips of a soft and uniform metal being required. Thus the $\frac{3}{8}$-inch tubes are made out of a strip 14 millimetres wide and .6 of a millimetre thick. At present such strips cannot be obtained of a greater length than 6,000 feet to 7,000 feet, and as 10 feet of strip are required for each 1 foot length of tube, the greatest continuous length that can be produced at the present time is limited, but it is thought that by means of electric welding this difficulty will

[1] From Engineering.

be overcome. The whole of the operations of forming the strip into the finished tube are accomplished in one continuous process by a single machine. The weight of the various sizes of tubing now manufactured ranges from $2\frac{1}{2}$ ounces per foot for the $\frac{5}{16}$-inch tubing, which is the smallest size manufactured, up to 17 ounces per foot for the $1\frac{1}{2}$-inch tubing.

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.*

On request in advance, one hundred copies of the number containing his communication will be furnished free to any correspondent.

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

Zoology in the Public Schools of Washington, D.C.

If there be one thing clearer than another to all thinking people of this or of any other highly civilized nation at the present time, it is that we are living in an age of great scientific progress. Among the dominant, most highly cultured races of the world this progress is characterized by its great rapidity, the exactness of its methods, and its far-reaching influence. It extends into all departments of human activity; it is felt along every imaginable line, both where the ends and aims are of a most utilitarian kind, as well as in quarters where the results arrived at appear to be, for a time, of a most impracticable nature. Solutions of abstract questions solved by the scientific philosopher and student, no longer, as of old, remain for an indefinite period hidden in an inaccessible literature, but quickly see the light in many places, and. in an incredibly short space of time, appear in the general literature of the day, in school and college text-books, and even in the daily newspapers. This being true, it was with no scant measure of surprise that the present writer had brought to his attention, very recently, a most remarkable case of misinstruction on the part of one of the teachers in a public school of Washington. It is no more than fair to say, however, that the statement made by the instructor to whom reference is made is supported by the author of one of the text-books in general use by the public schools throughout the District. The book in question is Mr. William Swinton's "Grammar School Geography," and in that production the author has adopted the plan of asking a series of questions, and then printing the replies to them on one of the maps given in illustration. On page 71 of his geography he asks, "What fish are taken in the Arctic region?" and on the accompanying map leaves the student to choose among a number of forms there given, none of which are *fish*, however, but where prominently occur such animals as the whale and the narwhal,— both of the last-named being typical and well-known marine mammals.

One of my sons attends the school to which allusion has been made, and it fell to his lot to get this question, and in making answer stated that no fish were named on the map in the Arctic regions; whereupon the teacher contended that both whale and narwhal were fish,—"and very big ones, too,"— directed him to take his seat, marked the reply against him as a miss, and appeared to be well pleased that the next scholar in turn replied more in keeping with his own notions in the premises, by stating that two large fish, at least, were found in the Arctic regions, and cited the two that have just been named. Now if there be one fact that zoology has made clearer than another, and it has been given in all authoritative lexicons, encyclopædias, and text-books throughout the world, it is that both the whale and narwhal are, as has been said, typical marine mammals, and belong just as much to the class Mammalia as does a man or a bear.

The believing that the whale is a big fish carries us back almost to the time when people entertained such erroneous conceptions of the earth and the creatures that live upon it, that it was popularly thought that the former was flat, that bats were birds, and horse-hairs could be converted into living hair-worms. My surprise is so great indeed at such a state of affairs existing in these times in our very midst that it absolutely forbids my making any comment thereon for fear that language might fail me to do the matter justice. It is surely high time that some effective course in elementary biology be included in our public school curriculum, and the sooner it is done, the sooner will our children come to be familiar with common facts, the true nature of things as they exist, and learn to appreciate the significance of a long-exploded idea when they meet with it. R. W. Schufeldt.

Washington, D.C., April 4.

The Question of the Celts.

Dr. Brinton, in the last number of *Science*, asks Dr. P. Max Foshay for evidence upon certain suggested points, and now I should like to follow his example, and ask Dr. Brinton for his evidence that Dr. Theodore Köppen "repeats the familiar error of attributing the theory of the origin of the white race in Europe to Dr. Latham; whereas, long before he mentioned it, it had been urged with clearness by Omalius D'Halloy, the distinguished Belgian anthropologist" (*Science*, vol. xix., p. 174). Both Otto Schrader, "Prehistoric Antiquities of the Aryan Peoples" (Jevons's translation), p. 85, and Canon Isaac Taylor, "The Origin of the Aryans," p. 20, agree in assigning this distinction to the late eminent English philologist, as propounded by him in "The Germania of Tacitus, with Ethnological Dissertations and Notes," London, 1851, Epiligomena, p. cxxxix. (now before me). Will Dr. Brinton refer me to the work of "the distinguished Belgian anthropologist," and inform me whether he is in any way related to the distinguished Belgian geologist, Omalius D'Halloy?

Also, I should be glad to be referred to the work of Broca, in which he states that "the small, brown, brachycephalic Celts are a mixed type" (*Science*, ibid., p. 117). I have always understood Broca to maintain that they are a pure type, the real Celts of Cæsar's time, and that they are now represented by the inhabitants of central France.

Again, what is Dr. Brinton's authority for calling the type "of tall stature, with reddish or blond hair, and dolicocephalic crania," the Kymric? Is not this the Scandinavian, or Teutonic type, of Penka, which he regards as the original Aryan type?

Dr. Brinton is surprised to find Professor Schaaffhausen of Bonn denying that "the bands who overran Italy in 393 B.C. were Celtic. Surely the title of their chiefs, *brennus*, 'king,' is evidence enough that they spoke a Celtic dialect" (*Science*, ibid., p. 146). But speaking a dialect is no proof of blood relationship, and I suppose Schaaffhausen thinks that the followers of Brennus were really Galated, or of German origin. This is the problem discussed by Niebuhr, "History of Rome" (English translation), vol. ii., n. 1,169, in which the testimony of Celtic authors is quoted to show that the hair of the invading Celts was yellow, or red, while all Celtic peoples now have black hair. Niebuhr thinks that the law of permanency of physical constitution does not hold good for the hair, since now yellow or red hair has become uncommon among the Germans and Scandinavians in most parts. Thus it would seem that we can rely neither upon linguistic nor ethnological arguments wholly to settle the vexed question of the Celts. Henry W. Haynes.

Boston, April 6.

AMONG THE PUBLISHERS.

The famous geographer, Élisée Reclus, has just received, says *The Publishers' Weekly*, an unusual honor from the Paris Geographical Society. It has long been one of the traditions of this society that its gold medal should be awarded only to explorers who make discoveries of the first importance. This year it has deviated from its time-honored rule and has awarded its medal to a writer instead of to an explorer. The honor was given to M. Reclus to commemorate the approaching completion of his great work, "Nouvelle Géographie Universelle." The work is in eighteen large volumes, and Reclus is now at work on the last one. Reclus began this immense task in 1875. It is a monument of geographical learning, and, though intended for the people and written in a popular style, it is thoroughly scientific in spirit and treatment. It is an interesting fact that if it had not been for the intervention of Darwin and other great scientific men of England this greatest of all popular geographies would probably never have been written, for Reclus, who is a Socialist in politics and who in 1871 was captured in Paris in the ranks of the Commune, had been condemned to penal servitude for life in New Caledonia, and he never would have been able to collect his material and write his book in that far-off Pacific island. Reclus was then 41 years old, and was already celebrated as a geographical authority. The hopes of his life, all the brilliant promise of his literary career, seemed in a moment blasted. The news of his great misfortune shocked the scientific men of all nations. In England they were prompt to act, and a petition, signed by all the scientific men of eminence in the country, was addressed to Thiers. The appeal was heard and the penalty of deportation was commuted to a sentence of perpetual banishment from France. Reclus has never since set foot upon his native soil, though the greatest work of his life has been brought out by Paris publishers. It is in Italy and Switzerland that he has been laboring for seventeen years on his "New Universal Geography," and the former political convict has produced on an average a volume a year, each book as large as a volume of the "New American Cyclopædia."

— *Babyhood* discusses in its April number the question whether children can outgrow catarrh. The writer, Dr. D. B. Delavan, takes strong ground against the popular idea that time will work a cure in the case of chronic catarrh and shows clearly the danger of neglect. Another important medical article is that on "Headaches of Children," by Dr. C. L. Dodge. The mothers themselves contribute a number of interesting letters to the "Parliament" on such topics as "Baby's Naps," "Rational Dress for Little Girls," "Gardening for Children," "The Traditions of the Elders," "Corporal punishment," etc.

—"Mutual Aid among Animals," by Geo. E. Walsh, is a notable article among the many good things in *Outing* for April. The article illustrates a pretty side of animated nature, and goes to show that mutual aid among animals is as apparent to the close observer as is the mutual struggle for supremacy.

— Houghton, Mifflin & Co. announce that they have in preparation a "History of the United States," by Mr. John Fiske, for the special use of schools. Mr. Fiske's world-wide reputation as a writer and scholar leads us to expect from him a School History

CALENDAR.

Women's Anthropological Society of America, Washington.

April 2.—Miss Woodhull, Report on College Extension; Mrs. Tullock, Report on Work of Deaconesses; Mrs. Kane, Report on Working Girls' Clubs.

Biological Society, Washington.

March 19.—The principal paper of the evening was: The Biological Basis of Psychology, by Professor Lester F. Ward. C. D. Walcott, On the Discovery of Certain Cambrian Fossils on the Coast of Massachusetts; F. H. Knowlton, The Fossil Flora of the Bozeman Coal-Field; C. W. Stiles, Notes on Parasites: Strongylus rubidus, Hassall and Stiles, 1892; H. E. Van Deman, Variations in the Fruit of Hicoria Pecan.

April 2.—The principal paper of the even ing was: The Interdependence of Plants and Insects, by Professor C. V. Riley. C. Hart Merriam, The Distribution of Tree Yuccas (illustrated); H. E. Van Deman, Variations in the Fruit of Hicoria Pecan; C. W. Stiles, Notes on Parasites: Two Stages in the Life History of Distoma magnum, Bassi, 1875 (F. americana, Hassall, 1891).

Philosophical Society, Washington.

April 6.—T. Russell, River Stage Predictions; J. P. Iddings, A Study of a Dissected Volcano; Waldemar Lindgren, The Silver Deposits of Lake Valley, New Mexico.

Anthropological Society, Washington.

April 5.—Symposium on the Nomenclature and Teaching of Anthropology. Opened by Dr. Daniel G. Brinton of Philadelphia.

Society of Natural History, Boston.

April 6.—Percival Lowell, Shinto Occultism, God-Possession of the People; Harold C. Ernst, Some of the Advances in Bacteriology.

unequaled in the purity of its English, in the fascination of its style, and in the accuracy of its statements. His hearty sympathy with the needs and possibilities of the school-room — as shown by the success of his historical lectures to school children, and by the popularity of his Civil Government for schools — assures us that he will employ his art to the great satisfaction of the practical teacher.

— A new book from the pen of Max O'Rell is announced by the Cassell Publishing Company It bears the startling title "English Pharisees, French Crocodiles, and other Anglo-French Typical Characters." Max O'Rell dedicates this new and lively volume "To Jonathan," to whom he says: "I have drawn a few sketches for you. Perhaps they will show you that people can be happy without rolling in wealth or living in a furnace." The book is about the same size as "Jonathan and His Continent." Max O'Rell was never more amusing than in these pages in which he shows up the good points as well as the weaknesses of his native land and the land of his adoption.

— The April (1892) number of *The Alienist and Neurologist* contains: "Surgical Cure of Mental Maladies"—Résumé, by Dr. Guiseppe Seppilli, Italy; "Some Principles Involved in the Nature and Treatment of Inebriety," by T. L. Wright, M. D., Bellefontaine, Ohio; "Art in the Insane," by J. G. Kiernan, M. D, Chicago, Ill; "Drug Habituation," by Lucius W. Baker, M. D., Baldwinville, Mass.; "Tumor of the Cerebellum," by George J. Preston, M. D., Baltimore; "The Epidemic Inflammatory Neurosis; or Neurotic Influenza," by C. H. Hughes, M. D., St. Louis; "Pessimism in its Relation to Suicide." by Wm. W. Ireland, M. D., Scotland; "Classification of Insanity," by C. G. Chaddock, Traverse City, Mich.; "Report of a Case of Transitory Frenzy," by Theo. Diller, M. D., Pittsburgh; "Intermittent Paralysis," by L. Bremer, M. D, St. Louis.

QUERY.

Can any reader of *Science* cite a case of lightning stroke in which the dissipation of a small conductor (one-sixteenth of an inch in diameter, say,) has failed to protect between two horizontal planes passing through its upper and lower ends respectively? Plenty of cases have been found which show that when the conductor is dissipated the building is not injured to the extent explained (for many of these see volumes of Philosophical Transactions at the time when lightning was attracting the attention of the Royal Society), but not an exception is yet known, although this query has been published far and wide among electricians.

First inserted June 19. No response to date.

N. D. C. HODGES,

874 BROADWAY, NEW YORK.

SCIENCE

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SCIENCE

NEW YORK, APRIL 15, 1892.

A NEW PATENT OFFICE.

In our issues of Jan. 29 and April 1, attention was called to the needs of the Patent Office and the great injustice which was persistently maintained against inventors, the public, the nation as a whole, and the official staff of the Patent Office by the criminal over-crowding of that office consequent upon the insufficient space assigned it in its own building, by the shameful absence of provision for ventilation, and, not least, by the introduction of the offices of the Interior Department into a building erected with the money of inventors taxed heavily for the privilege of giving a wealth and a prosperity to their country, far beyond anything seen elsewhere in the world.

We now observe that the daily papers report that on the 7th instant Senator Falkner introduced a bill, not to give the Patent Office the control of its own building and to appropriate the $4,000,000 or so much as may be needed of it to the extension and improvement of that building, *but* to erect a new building. The cost is not to exceed $3,500,000, and $500,000 is appropriated to begin the work. In other words, this proposition—it may never be more—is to give to the Interior Department a building erected at a cost of $3,000,000 by the inventors of the country, mostly poor men struggling against every misfortune, and *then* to take an additional $3,500,000, also contributed by these needy inventors for the privilege of making their country and its already wealthy men still wealthier, and appropriating *that* to the construction of *another* building for the Patent Office. In other words still, it is proposed to take of the $7,000,000 which we have, in the course of the century, forcibly wrenched from the almost empty purses of our thousands of talented but needy inventors as a tax upon them for enriching their country, one-half the whole for the construction of a building that it is a disgrace to the nation not to have given them long ago, and to give the other half to a Department which has absolutely no claim upon it, which has been an incubus upon the work of the Patent Office for years, and which is to-day through the exercise of technical legal power and in defiance of justice and public policy, a "squatter" on the territory of the Patent Office and a nuisance there. It seems remarkable that this should be possible, in the face of justice and in spite of the united power of all the inventors in the land, of all their representatives, and of all the members of the legal profession who are daily earning their fees by doing the business of these wronged inventors. The whole matter is a standing disgrace to the country and our representatives in Congress, and a crying injustice to the men who have built up the whole modern system of production of the United States.

The *Scientific American*, referring to proposed legislation by which it is provided that foreign inventors shall be taxed the same amount in this country as in their own for such protection, says:—

"The theory upon which we grant patents and the object of our patent laws is the promotion of useful arts and industries, not the taxation of inventors. The aim of our patent laws is to encourage the study and development of new inventions, whereby multiplied and diversified forms of novel industries are made accessible to the people; for by industries they thrive. The American law as it stands invites inventors throughout the world to bring hither their new inventions and set up their new industries. In reward for so doing it grants them a patent for seventeen years, after which the invention becomes free to the public. The larger the number of patents granted, the greater will be the number of new industries established, and our measure of prosperity will be correspondingly increased. As a people we have everything to gain and nothing to lose by encouraging inventors, no matter where they live or where they were born."

It is in this, as we consider it, correct theory of the patent system that all our legislative action and every policy relative to patents should be determined. Make the patent-fees as small as is practicable; stimulate inventors to bring out their inventions; insure the most complete and perfect protection; and give the inventor at least the full worth of his money. It is scandalous and disgraceful to tax a poor man for the privilege of promoting the best interests of his country. Not one inventor in thousands acquires a competence; but the inventions of these very men make the nation and its capitalists rich. If the whole $7,000,000 contributed by them to the Patent Office treasury is needed to insure this they should have it—and ten times more if good use can be made of it.

OBSERVATIONS ON THE GROWTH AND CHEMICAL COMPOSITION OF THE MAIZE (CORN) PLANT.

June 12, 1891, seventy-five hills were selected in a field of Leaming corn planted May 15. Each hill contained three corn plants, and they were as nearly uniform in appearance as could be found in the field. The seventy-five hills were divided into fifteen lots, each lot containing five hills. Beginning June 12, and every week thereafter during the season, the plants in four hills of corn in one plat were cut close to the ground. The plants from one of these hills were dried and preserved. A chemical analysis was made of the plants from each of the remaining three hills, so that during the growing season these analyses were made of triplicate samples taken each week. The fifth hill of corn in each lot was left to grow, and was measured each week during the season. Each corn plant in the seventy-five hills was measured every week until it was cut. These measurements included the height to the tip of the upstretched longest leaf and also to the tip of the tassel when it was present, making a total of 3,159 measurements.

The soil in which the corn was grown was very uniform prairie land, located in central Illinois. The season was below the average for corn-growing because of the drouth.

Like almost everything else that grows, the plants did not all make the same amount of growth in height each week. There was quite a variation in the growth of the different stalks, the maximum height being reached about Aug. 1; but, as will be seen further on, the plants had acquired at that time less than one-half of their total dry matter.

A condensed summary of some of the observations made is given in the following table: —

During the week ending Aug. 14 the record shows that for this season an unusually large quantity of rain had fallen, and the plants which were analyzed that week showed a smaller quantity of dry matter than those of the week before.

Week Ending.	Number of Plants Measured.	Height of Plants (inches).		Field-Notes.	Dry Matter per Plant (grams).	Rain-fall (inches).	Average Daily Temperature, Fahr.			Percentage Composition of Dry Matter.				
		Extremes	Average.				Mean.	Maximum.	Minimum.	Ash.	Protein.	Crude Fibre.	Nitrogen Free Extract.	Ether Extract.
June 12	2 5	11–26	16			.48	66	76	55					
19	225	23–43	31		4.5	.30	75	90	62	11.2	27.5	23.3	35.7	2 2
26	213	32–64	47		19.9	1.20	75	86	60	11.8	24.1	25.4	36.7	1.9
July 3	201	50–84	65		30.4	.03	72	85	58	11.5	19.1	28.1	39.4	1.9
10	189	57–91	73		50.0	.07	68	81	51	10.5	19.1	29.2	39.5	1.6
17	177	59–102	84		114.2	.47	72	86	57	8.9	15.7	30 6	42.8	1.8
24	165	64–111	96	Full tassel.	161.5	.20	73	86	60	7.9	12.1	29.1	49.2	1.6
31	153	81–115	98	Silks alone.	161.2	.67	68	80	54	7.1	11.3	28.1	51.0	2.4
Aug. 7	141	82–116	93	Pollen shed. Silks dead.	215.1	.01	71	87	55	6.0	10.8	26.7	54.6	1.8
14	129	82–118	98		200.0	1.35	74	94	62	6.8	10.8	29.5	51.2	1.5
21	117	82–118	97	Roasting ear stage.	256.0	1.28	75	86	67	6.2	10.3	27 5	53.9	2.0
28	105	82–115	97	Corn denting.	294.9	.13	62	74	50	5.7	9.3	24.7	57.5	2.6
Sept. 4	93	81–114	97	Husks turning brown.	349.5	.34	63	77	49	5.1	8.5	21.7	61.7	2.9
11	81	81–114	96		319.7	0	62	76	46	5.0	8.9	20.4	62.8	3.0
18	69	81–113	93	Husks dry. 50% leaves dead.	290.0	.0	73	90	57	5.2	9.7	19 7	62 5	2.8

The figures giving the grams of dry matter per plant and the composition of the dry matter represent an average per plant of the nine analyzed each week, or three hills of corn, each containing three plants. No attempt was made to separate the different parts for analysis, such as the ear, stalk, and leaves, but that part above ground was taken as one plant.

The rainfall during the season was considerably below the average, and is here given in inches: —

Average.	June.	July.	August.	September.
For ten years.	5.04	2.75	3.45	3.27
For 1891.	2.08	1.41	2.86	0.41

The record shows that the average maximum height per plant was attained during the week ending July 31; but it contained at that time only 46 per cent of the maximum quantity of dry matter.

The growth in dry matter continued till Sept. 4, and the decrease after that date probably was due to breaking off and blowing away of dry or dead portions of the leaves.

Assuming the total height per plant to be 100 inches and that it was 19 inches high June 12, or 19 per cent of its total height, also that the maximum growth in weight was 350 grams of dry matter, the percentage of the total height and weight attained each week is as follows: —

The analyses of the dry matter show that 100 pounds of the corn plant has quite a different composition at the various stages of its growth. The percents of ash, or mineral matter, and also of protein are highest when the plant is young, and these decrease with age; while the nitrogen-free extract, or carbo hydrates, increases in percentage as the plant matures.

Assuming that there are 10,000 corn plants per acre, which number it has been found is a fair estimate of the thickness of planting in Illinois, these analyses show that an acre of corn grown to maturity contains 7,716 pounds of dry matter, and this dry matter is composed of 394 pounds of ash, or mineral matter, 656 pounds of protein, and 6,666 pounds of carbo-hydrates.

E. H. Farrington.

Chemist, Agricultural Experiment Station, Champaign, Ill.

THE TOMB OF KING AMENHOTEP.

The tomb of King Amenhotep IV. has at last been brought to light in the nekropolis of Tel-el-Amarna in middle Egypt.

Since the close of the year 1890 the direction of explorations in Egypt has been occupied in clearing the two most

	June 12	19	26	July 3	10	17	24	31	Aug. 7	14	21	28	Sept. 4	
Height.	19	13	17	19	9	10	11	2 = 100 total.						
Weight of Dry Matter.		1.3	4 6	3 2	5 8	18.5	12	0	15.6	0	11.9	11.3	15.8	= 100 total

The omission of two weeks in the record where no increase in dry matter was found is caused by the fact that we cannot have the plant and analyze it too.

important groups of graves in the neighborhood of this site, which belonged to the eighteenth dynasty, and many tombs have already emerged from the heaps of *debris* under which they lay concealed, and their entrance had been protected with iron doors.

One of these, No. 25 on the plan, has at last been identified as the long looked-for hypogeum of the king. The main entrance-passage, cut into the mountain to a depth of fifty metres, opens into a chamber supported by four pillars. To the right of this passage, another corridor, forty-five metres long, branches out, opening into an unfinished chamber thought to be that of the queen. Somewhat further, on the same side, are three chambers, two of which are decorated with paintings; and among these occurs the name of the young princess Aten-Macht, the second daughter of Amenhotep IV. The decorations on the walls of the king's chamber represent him surrounded by his family, in adoration before the sun. The condition of the tomb when found showed it to have been disturbed in ancient times, a fact for which the circumstances of this reign furnish abundant explanation.

Until 1887 all that was known of Amenhotep IV. was that he peacefully succeeded his great father, Amenhotep III., whose queen was a foreigner; but that having selected for his only god the life and light-giving sun-disk "Aten," and having attempted to establish his worship to the exclusion of that of other gods, and particularly of that of Amon, he antagonized the arrogant priesthood, whose growing power was already then a force that the Pharaohs must count with. In consequence of this, he found it expedient to leave Thebes and to remove his court and the seat of government to middle Egypt, where, at some seventy-five kilometres south of Minieh, he founded the new city, "Khu-n-aten," i.e., Splendor of the Disk, the site of which is now known as Tel-el-Amarna.

Consistent in his unconpromising hatred of Amon and his priests, he changed his own name in which that of the now discarded god of his fathers entered as an element, and was henceforth called "Khu-n-aten."

He seems to have been a devoted husband and father, and the worship he introduced — and which, after all, was but a return to ancient sun-worship, and therefore more of a reform than an innovation — seems to have been a lofty one, if one may judge from the aspirations kindled by it in the souls of its worshippers, as expressed in the beautiful hymns that have come down to us.

Khu-n-aten left only daughters. At his death his sons-in-law, who succeeded him, had not the strength to continue the struggle; they gradually abandoned his faith to return to the old popular worship, and the eighteenth dynasty closed with a period of disturbance, indicated by the shortness of the reigns.

Was Khu-n-ated only a religious reformer, a mere fanatical monotheist, who, as has so often been stated, was urged by a devout foreign mother to break with the traditions of his father's race, and whose blind intolerance tried to enforce his own views upon his people? or was he a shrewd, far-sighted prince, who, perceiving the danger to the royal power lurking behind the increasing pretentions of the Theban priesthood, sought to put a check upon their encroachments and to insure the independence of the crown by removing the court and by surrounding himself with foreigners, thus defying this formidable caste?

The latter view receives support from the fact that it is against Amon alone that the king's animosity was practically directed, and that, whilst the worship of the disk was the official religion of the capital, the names of the other divinities of Egypt remained undisturbed upon the monuments of his reign, and Amon's name alone was everywhere erased.

In 1887 the discovery of the archives of Khu-n-aten, consisting of some three hundred cuneiform tablets, containing important correspondence between Egypt and its Asiatic allies and tributaries, as well as official reports from royal lieutenants in foreign lands, threw a most unexpected light upon the condition of the ancient civilized world in the fifteenth century B.C. Among the many interesting glimpses thus obtained is a mention of Canaan in pre-Exodus times, found in a letter from the tributary king of Jerusalem, which reveals the existence of that city at that remote period.

The fact that the correspondence between Asia and Egypt was conducted in the Neo-Babylonian characters was alone sufficiently extraordinary to draw the attention of the learned world to Tel-el-Amarna and to the remarkable figure of the man who, in his day, filled not only that spot, but no doubt the whole civilized world, with his strong personality. There are many peculiarities connected with the monuments of his reign and with the art they betray that have never yet been quite satisfactorily explained; and despite all that has been written, and the ingenious theories that have been advanced on the subject, there still remains enough that is hypothetical to make any monumental discovery connected with this period of the greatest interest to scholars.

S. Y. STEVENSON.

A SIMPLE APPARATUS FOR THE PRODUCTION OF LISSAJOU'S CURVES.

THE requisites are a piece of thin glass tube or rod, a gas flame, and a slight knowledge of elementary glass working. The apparatus consists of a short piece of rod or tube which serves as a base or handle, to which is fused a glass thread ten or fifteen centimetres long and from one-half to one millimetre thick, carrying at its extremity a second and much thinner thread of about the same length, whose free end is fused into a small clear bead. Both threads are in the same line with the handle, and the whole forms a compound rod.

In constructing this rod, two glass threads of the kind already indicated are selected rather longer than required. They are fused together, and the connection straightened by a gentle pull while still soft. The double rod is then held near its centre, and the finer thread shortened until in vibration it appears, by persistance of the visual impression, as a sheet or cone. The thicker thread is next adjusted in the same way until the vibration of this double rod, when held by its thicker end, is sufficiently rapid. This thicker end is now attached to a larger piece of glass (the handle), and a very small bead formed at the other end. The exact position and weight of the bead required to form any given set of curves must be found by trial.

Now, holding the bead in a strong light, stand nearly facing the light, but so as to see the bead with a dark background, and tap the handle lightly with the finger-tips. If the adjustment is perfect, the bead will appear transformed into a shining curve, oscillating or rolling and twisting upon itself with inimitable grace like a living thing, and dying away with the decreasing amplitude of the vibrations.

These curves are represented approximately by the equations: —

$$x = a \cos m\theta$$
$$y = b \sin (n\theta + \alpha),$$

where a and b are the amplitudes, α is the phase-difference, and the ratio $m:n$ is a function of the time. When the ratio $m : n$ can be expressed by small integers the curve is completely shown by this apparatus. When this ratio cannot be expressed by small, but can by moderate, whole numbers, the curve cannot well be seen, but may be readily photographed. The most beautiful effects are seen when the ratio $m : n$ has almost some such values as 1:1, 1:2, 2:3, or 3:1. The values of a, b, and α vary with every tap of the finger, and thus a single apparatus will show a great variety of curves of one class.

I have not tried projecting these curves with a lantern, but I see no difficulty in the way of such a proceeding.

Clark University. T. Proctor Hall.

VALUABLE EXPERIMENTS IN VEIN-FORMATION.

In No. 3, Vol. XII., of the *School of Mines Quarterly* there appeared a short paper "On the Genesis of Ore-Deposits," by W. H. von Streeruwitz, the chief of the Western Division of the State Geological Survey of Texas.

In these days of hasty conclusions and the overcrowding of scientific literature with opinions and half-developed theories, it is refreshing to run across an occasional example of undue modesty in presenting the results of elaborate experimentation. My excuse for thus tardily calling attention to a marked case of this character, entirely without the knowledge of the author, is the conviction that the gentleman himself will not lay claim to full credit for the work which he has planned and executed in a thoroughly scientific manner. Especially does this action seem fitting as preliminary to an extension of the same investigations by the present writer in the metallurgic laboratory of the Arizona School of Mines. In fact, it is only just to confess that the inspiration of these last experiments, for which preparations are now being made, came originally and wholly from the most interesting results of Professor von Streeruwitz's patient and intelligent observations in his laboratory at Houston, Texas.

In the paper quoted Professor von Streeruwitz does not make very clear how much of the value of his well-fortified conclusions rests upon the skill with which he has himself conceived and executed a most convincing series of experiments. But those who have seen some of the tubes with miniature veins of gold, silver, copper, lead, etc., and others with beautifully formed agates, need only the concise reasoning of the article referred to, in order to understand the originality, perseverance, and devotion to truth with which the investigation has been carried out through several years of diligent experimentation.

In the language of our author, the experiments would, so far, appear to establish the following points, viz.: —

1. It is principally the iron which, in silico-ferruginous fissure veins, brought the other metals from greater to (by mining) accessible depths.

2. Most siliceous ore-leads, carrying also large quantities of iron and having silico-ferruginous outcrops, seem to be deposited from hot aqueous solutions of the metals and silicates.

3. Metals and metal combinations contained in the rock surrounding the fissures and crevices were probably leached out by the hot liquids contained in the fissures and precipitated on and combined with the siliceous iron growing up in the fissures.

4. The fissures could be charged with ore-veins in a comparatively short time, since, no doubt, high temperature and galvanic currents existed in the fissures at the time of formation of the ore-gangues.

5. In contact-gangues the precipitation and deposition of ores was materially facilitated by galvanic currents caused by the contact of different rocks, and it is owing to the prevalence of galvanic currents that in most cases richer deposits at the intersection of two or more leads were formed.

6. The so-called iron outblows ("gossan," "eiserner hut," "Pacos," "Colorados," etc.) are frequently not the product of igneous eruption, but a deposition product from aqueous solutions; and alterations in the rocks contiguous to such outblows are not necessarily the result of eruptive agencies, but of a leaching process.

7. The formation of banded agates does not always take place, as is generally believed, in the cavities of a rock, but can also occur free in solutions; and the thickness of the bands progresses from the centre outwards, although a reverse process by osmosis may be possible under certain conditions.

The bases for these conclusions are somewhat more explicit than might, perhaps, be inferred from a reading of Professor von Streeruwitz's paper alone, but, as he is most careful to insist, the experiments possess their greatest scientific importance in the element of suggestiveness for future inquiry. It is remarkable that so little has heretofore been done in such directions; and, like the admirable flexure tests of the United States Geological Survey in orographic work, they point out little-trodden fields in geology which offer rich rewards to capable investigators who will approach the problems in inductive experimental mood, following the guidance of results as they are gradually manifested.

No one will be better pleased than Professor Streeruwitz to know that others are earnestly engaged in this study. The incidental discoveries, whatever they may be, are liable to prove as interesting and valuable as any which may be directly sought. Indeed, it is impossible at this juncture to predict to what legitimate length the investigation may lead.

The main thing to be desired is the inauguration of a large number of experiments with as widely varied conditions as possible of material, situation, environment, and activity. While co-operation is not really essential, it can do no harm and may result most beneficially. May not some of our zealous young geologists be induced to undertake this work, which should be continued with constant observation for a term of years?

Instruction will gladly be given to any who may require it, and from those who cannot otherwise aid the cause thoughtful suggestions will be most welcome.

Theo. B. Comstock.

Director School of Mines, Tucson, Arizona.

ROYAL METEOROLOGICAL SOCIETY.

At the meeting of this society on Wednesday evening, March 16, Dr. C. Theodore Williams, the president, delivered an address on the "Value of Meteorological Instruments in the Selection of Health Resorts." He drew attention to thermometers, maximum and minimum, as the foundation-stone on which medical climatology rests, and instanced effects of extreme cold or heat on the human organism. The direct rays of the sun are of the greatest importance, and in health resorts should be utilized to the full; in fact, only climates where, during the winter months, even a delicate person can lie or sit for several hours a day basking in the sunshine are to be recommended for most complaints, and the various forms of sunshine recorders are used to aid the medical adviser in choice of such health stations.

After referring to the value of rain-gauges, hygrometers, and barometers, Dr. Williams stated that many health resorts owe their reputation almost solely to their shelter from cold winds; for instance, the advantage in climate which Hyeres and Mentone enjoy over Marseilles is chiefly due to their being more sheltered from the mistral, or north-west wind, the scourge of the lower valley of the Rhone from Valence to Avignon. He went on to describe the climate of the Riviera, illustrating it by lantern slides from recent photographs, including views of Hyeres, Costabella, Cannes, Nice, Mentone, San Remo, etc., and he showed the three principal causes of the warm winter in this region to be: (1) the southern latitude; (2) the protection from cold winds by mountain ranges; and (3) the equalizing and warming influence of the Mediterranean Sea, which being practically tideless is always equally potent, not varying with hour and season. Dr. Williams mentioned the weak points of the south-of-France climate, with its blustering mistral, its occasional cold bise, its moist sirocco-wind; but summed up the Riviera winter climate as being, on the whole, clear, bright, and dry, with fog and mist practically unknown, with a winter temperature of 8° to 10° higher than England has, though subject to considerable nocturnal radiation, with about half the number of rainy days and four to five the number of bright ones which she can boast of, with cold winds and cold weather, without which it would lose its health-giving effect.

After the delivery of this address the meeting was adjourned in order to allow the fellows and their friends an opportunity to inspect the exhibition of instruments relating to climatology which had been arranged in the rooms of the Institution of Civil Engineers, 25 Great George Street. The Meteorological Office showed a set of instruments necessary for the equipment of a climatological station, viz., Stevenson thermometer-screen, fitted with dry-bulb, wet-bulb, maximum and minimum thermometers; and also a rain-gauge. Thermometers were also shown for ascertaining the temperatures on the ground, under the ground, and at a distance, as well as for recording temperature continuously. Various forms of sunshine recorders were exhibited, as well as a number of actinometers and solar radiation instruments for ascertaining the heating effect of the solar rays. The exhibition included a large and interesting collection of hygrometers, also several rain-gauges and other instruments. Among the curiosities is a piece of plate glass which was "starred" during a thunder-storm on Aug. 21, 1879; this was not broken, but it has a number of wavy, hair-like lines. The exhibition contains a large number beautiful photographs of clouds, lightning, and snow-scenes, as well as of the damage done by the destructive tornado at Lawrence, Mass., U.S.A.

NOTES AND NEWS.

On April 16, at the Department of Archæology and Palæontology of the University of Pennsylvania, will take place the opening of the Loan Collection of Objects used in Worship, already referred to in these columns

— A very intense light, such as is required for photographic or occasionally for medical purposes, may, as is well known, be readily obtained by burning magnesium ribbon, which has, however, the disadvantage of being somewhat expensive. An excellent substitute, according to *Lancet*, has been found by a French chemist, M. Villon, in aluminium, which is about a third of the price of magnesium, and which may be utilized in the same manner by burning it in a spirit lamp, or, if a flame of much more intense brilliancy is required, in a coal, gas, or spirit flame supplied with a jet of oxygen. In these it burns without emitting fumes, in which respect it is superior to magnesium. The light given by aluminium has a high actinic power — nearly as high, indeed, as that of magnesium. The most convenient way of obtaining a very intense light, according to M. Villon, is to use a lamp provided with a jet of oxygen at the centre of its flame, into which powdered aluminium mixed with a quarter of its weight of lycopodium and a twentieth of its weight of nitrate of ammonium can be projected by means of a tube furnished with an air-ball. This gives an exceedingly intense light, without smoke. A mixture of aluminium powder with chlorate of potash and sugar can be ignited, giving an intense light by means of gun-cotton, but is somewhat dangerous. Probably the best plan for medical photography, or for laryngoscopic and auroscopic and other demonstrations, would be to burn a ribbon of aluminium in an ordinary spirit lamp. Of course, if oxygen and an oxy-hydrogen, or an oxy-alcoholic, lamp were at hand a much more intense light could be obtained.

— The London *Times* of March 24 printed the following communication from a correspondent: Under the direction of the Austrian Government an interesting series of deep-sea explorations has been conducted recently in the eastern parts of the Mediterranean, by a scientific party on board the "Pola." At one point, about 50 nautical miles south-west from Cape Matapan, the "Pola" found a depth of 4,400 metres (2,406 fathoms), followed within a few miles further east by a depth of 4,080 metres (2,236 fathoms), which are the greatest depths recorded in the Mediterranean. They have received from the Austrian Hydrographical Board the name of Pola Deep. The great depression of the Mediterranean must thus be shifted considerably east from its former central position on the maps. Another deep area was explored between Candia and Alexandria—the depths attaining from 3,310 metres (1810 fathoms) some twenty miles south-east of Grandes Bay, and from 2,392 metres (1,208 fathoms) to 2,120 metres (1,322 fathoms) within a short distance from Alexandria; the maximum depth sounded being 3,068 metres (1,678 fathoms) in 28° 39′ 30″ north latitude, and 33° 19′ 54″ east longitude. The highest temperature was found during the first part of the voyage, at depths of 1 to 50 metres, the highest being 80.8° Fahrenheit at 1 metre; the lowest temperature, 52½°, was observed at the issue from the Adriatic Sea, at a depth of 760 metres. In explorations conducted some two years ago in the Central Mediterranean, it was observed that the density of the water and its saturation with salt increased with depth, and the same was noticed in the western part of this year's cruise. But in the Eastern Mediterranean the density of water varies but very little in the different strata, and it is higher on the whole than in the west. The transparency of the water is very great in the Eastern Mediterranean. Altogether the "Pola" made no fewer than 50 deep sea soundings, 27 of which touched depths of more than 1,000 metres.

— P. Blakiston, Son, & Co., Philadelphia, announce that they will soon publish "Physical Education," by Frederick Treves, F.R.C.P. The subject of physical education as a hygienic measure has recently attracted so much attention from school boards, the medical profession, and sanitarians generally, that it now ranks in importance with the various branches of study pursued in our public schools and colleges. To the average city man or woman of sedentary occupation physical exercise is of quite as much consequence as it is to school children and college students. It is, however, often taken up unwisely and to the lasting harm of those who in ignorance attempt methods that are unsuited to their physical condition. It has therefore been thought advisable to publish, from the advance sheets of "A Treatise on Hygiene," this paper by one of the best known medical writers of the day, that it might be within the reach of those who would not perhaps care to purchase the larger work in which it will be included.

— Houghton, Mifflin & Co. announce that Mrs. Olive Thorne Miller adds to her two excellent books about birds already published by this firm a third, to which she gives the title, "Little Brothers of the Air." It describes between twenty and thirty different birds, and for all lovers of birds, who are happily very numerous, this little book has special attractions. Professor Child has prepared the eighth part of his remarkable edition of "English and Scottish Popular Ballads." It was originally expected that the work would be complete with the eighth part, but Professor Child has been successful in discovering a good deal of material which he had hardly anticipated finding, so that at least one more part is necessary to complete the work. "The Satchel Guide for the Vacation Tourist in Europe" has been revised for 1892, and, as heretofore, holds the first rank among Guides for those who wish to cover only a part of Europe, and make a tour instead of a thorough continued study of many places.

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Attention is called to the "Wants" column. It is invaluable to those who use it in soliciting information or seeking new positions. The name and address of applicants should be given in full. so that answers will go direct to them. The "Exchange" column is likewise open.

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THE EVOLUTION OF COMMERCE.[1]

FOR over three thousand years the great highway for commerce has been from India by the Persian Gulf and the Euphrates or by the Red Sea to the Mediterranean, and thence through the Mediterranean by Gibraltar to western and northern Europe, and, in our day, thence to America.

Along this route cities and nations have sprung up, increased in wealth and power, and passed away, giving place to other cities and nations further westward. These nations have been great carriers and distributors of minerals and goods, as well as capitalists and bankers, or carriers, bankers and manufacturers; in either case controlling the commerce of the world. This control has never for any long period been held by the same race, but has passed from one nation to another, always from the east toward the west.

The earliest highway of commerce was from India through the Persian Gulf, up the Euphrates to the Mediterranean; and carpets and precious stones were then as now carried over this route. Explorations and surveys for a railroad have been recently made along this "our future highway to India." Caravans brought spices from Arabia and rich stuffs from Babylon and Nineveh to the shore of the Red Sea. Solomon made a navy of ships and Hiram sent in the navy his "Servants, shipmen that had knowledge of the sea, and they brought gold from Ophir, great plenty of almug trees, and precious stones."

Tyre and Sidon founded colonies on the shores of the Mediterranean, enslaving the Spaniards and compelling them to work the mines of gold and silver already opened in Spain. Their ships sailed through the Mediterranean, by the Pillars of Hercules, into the Atlantic Ocean, turning northward to England for tin and copper and on into the Baltic Sea for furs and amber; turning southward along the western coast of Africa, passing certainly two thousand miles to the equator and probably rounding the Cape of Good Hope into the Indian Ocean. Products from the west were brought in ships to Tyre and Sidon and exchanged for the goods of the east, their merchants making profits on each transaction both as merchants and as carriers. Tyre and Sidon became wealthy, luxurious, and effeminate. Some of their citizens saw in Africa a richer soil and a better situation for a large city, and founded Carthage. The Carthaginians inherited the trade of Tyre and Sidon, and in addition opened highways to Egypt and into the interior of Africa, bartering their wares in Egypt for corn and grain and in Africa for ivory, gems, and slaves. They planted colonies in Africa and Sicily, and for a time were successful rivals of Greece and Rome.

The rule of the ocean transferred from Asia to Africa remained there but a short time, for the day of Europe came with the rise of Greece and Rome.

The Greeks founded colonies in Asia Minor, Sicily, and Italy. The ruins of great cities with Grecian temples and amphitheatres are found at Girgenti and Syracuse in Sicily, at Pæstum and other places in Italy. Under Pyrrhus, their armies were defeated by the Romans and their colonies captured. Deprived of these, their power rapidly declined and Greece became a Roman province.

Rome.

Rome founded few colonies, but she conquered the nations of Asia, Africa, and Europe, and brought under her sway cities, kingdoms, and empires. She boasted of five hundred cities in her Asiatic province that had been founded or enlarged and beautified by the Cæsars. One hundred and twenty vessels each year brought the goods of India from the delta of the Ganges, and large fleets from Egypt came laden with corn and grain. She imported from every country, but exported little, paying for her imports by taxes levied on her colonists.

Rome was the first power to incorporate conquered states into her dominion and extend citizenship to all the people in her empire; so that Paul could say in truth, "I am a Roman citizen and to Cæsar I appeal." So salutary and beneficial was her rule that under it these countries prospered more than under their own rulers. What Rome seized with strong hands she defended, and in return for taxation gave protection. She has no more enduring monuments than her roads, the remains of which are now found in every country of Europe. Though built as military and post-roads, they were used largely for commerce. All started from the golden mile-stone in the forum; one ran over the Brenner pass north-eastward to the Baltic Sea, another followed the north-western coast of the Mediterranean to Spain and southern France, another crossed the Alps and extended through France to the British Channel and through England to Scotland, where the Romans built a wall, ruins of which now bear witness to its strength. Another way went southward to Naples and Brindisi, and another led eastward to Macedonia and Greece. As these were the only roads in all these countries, it was truly said, "All ways lead to Rome;" and over them the messengers of Cæsar travelled more rapidly than the mail-carrier of our fathers on our mail-routes.

Venice and Genoa.

After five hundred years of empire Rome fell, and the Dark Ages followed. From A.D. 400 to A.D. 800 commerce and trade died out. The only vessels on the Mediterranean and Baltic were piratical crafts; Jerusalem and the Holy Land were captured by the Turks; the Crusades began, forerunners of a higher civilization and more extended commerce. Thousands and tens of thousands of people from all parts of Europe and all ranks of life, bearing the pilgrim's badge — the blood-red cross — journeyed toward the Holy Land, first in vast crowds led by Peter the Hermit, then in great armies led by kings and generals. For two hundred years this movement continued. Venice and Genoa furnished ships to carry the armies of France from Italy to the Holy Land. The Venetians were shrewd merchants and drove hard bargians, stipulating for cessions of land at the best commercial points and adequate compensation for their services. After the failure of each Crusade they brought back remnants of the troops and pilgrims, and with them the products of Asia Minor, and books and art treasures from Greece. These were distributed all over Italy, and led to the renaissance of the thirteenth and fourteenth centuries.

The trade with the East brought power and wealth to Venice

[1] Annual address by the president, Hon. Gardiner G. Hubbard. Presented to the National Geographic Society Jan. 15, 1892. Nat. Geog. Mag., Vol. IV., 1892.

and Genoa. They founded colonies on the Black Sea, in Asia Minor, and on the Asiatic coast. Venice alone had three thousand merchant vessels. Their commerce was not confined to the borders of the Mediterranean, for the goods of the Orient were distributed by the way of Augsburg and Nuremberg to the interior of Germany and to the towns of the Hanseatic Confederation. Thus commerce was opened with the interior of Europe.

By the failure of the Crusades, the power of the Turks, which had been for the time checked, grew and increased. They conquered the holy places of the earth, Asia Minor and Syria, and finally, crossing into Europe, gained Constantinople. The colonies of Venice and Genoa were captured; their fleets disappeared from the Mediterranean. In western Europe the Spaniards under Ferdinand and Isabella conquered the Moors, who for many ages had occupied the larger portion of Spain; and as the Crescent appeared in eastern Europe, the Cross triumphed in the west.

Spain and Portugal.

Then a new power appeared upon the stage. Spain and Portugal entered upon an era of exploration and discovery in regions unknown to Venice and Genoa. Commerce, which in the Middle Ages had been confined to the Mediterranean Sea, was now extended to the countries on the Atlantic Ocean, and the Cape Verde Islands, Madeira, and the Canaries were discovered. In one generation (between 1470 and 1500 A.D.) more and greater discoveries were made than in any other period of the world's history. The Portuguese sailed along the eastern coast of Africa and rounded the Cape of Good Hope; Vasco de Gama crossed the Indian Ocean to India; Columbus sailed westward to find the Orient, and discovered a New World; Magellan circumnavigated the globe; Balboa crossed the Isthmus of Panama and was the first to see, on the same day, the sun rise out of the Atlantic and set in the Pacific; and soon the eastern and western coasts of America were explored from Newfoundland to Cape Horn and from Cape Horn to Panama.

Both Portugal and Spain claimed all the New World, and as they could not agree upon a division of territory they referred the matter to the pope, who divided the New World between them. The Atlantic became the great highway for commerce, while the Mediterranean was deserted, and Venice and Genoa existed only in the past.

The commerce of Portugal was coextensive with her dominion, which extended from Japan and the Spice Islands and India to the Red Sea, thence to the Cape of Good Hope; and with their possessions on the eastern and western shores of the Atlantic and in Africa and Brazil completed their maritime empire, the most extensive the world has ever seen. Then a single fleet of one hundred and fifty to two hundred and fifty caracks sailed from the port of Goa to Lisbon; now there sails but one vessel a year from all India.

From Spain ships sailed both to the Caribbean Sea and to Cape Horn and thence to Chile and Peru, or directly north-westward from Cape Horn to the Phillippine Islands. Spain conquered Mexico, Central America, and all South America except Brazil. The gold and silver of Peru and Chile and the goods of the Orient were brought to Spain and Portugal. As their wealth and power increased the spirit of exploration decreased, and for nearly two hundred years the Spanish ships sailed in a fixed course by the same lanes, exploring the ocean neither toward the north nor the south, leaving undiscovered the great continent of Australia and numerous groups of islands.

The Spanish and Portuguese leaders were cavaliers who despised all commerce excepting in gold and silver, all kinds of manufactures, all manual labor, and the cultivation of the ground; they came not to colonize, but to satisfy by the labor of the enslaved aborigines their thirst for gold and silver. The whole political power was retained by the king of Spain and administered by Spaniards. While the silver and gold of America and the wealth of the Indies poured into the treasuries of Spain they wanted nothing more. Like ancient Rome, they took all the wealth of the conquered countries, making no return; but they did not, like Rome, give wise and equitable laws and a stable government to the countries they conquered.

The Netherlands.

The inhabitants of the Netherlands were manufacturers, and supplied the markets of Spain and Portugal and their colonies, thus reaping as large profits from their trade with these countries as the Spanish and Portuguese from the mines of gold and silver.

No part of Europe, says Motley, seemed so unlikely to become the home of a great nation as the low country on the north-western coast of the continent, where the great rivers, the Rhine and Scheldt, emptied into the North Sea, and where it was hard to tell whether it was land or water. In this region, outcast of ocean and earth, a little nation wrested from both domains their richest treasures.

The commerce of the Hanseatic towns, which had depended for their trade on Venice and Genoa, became less and less as the glory of those cities waned. Antwerp, with its deep and convenient rivers, stretched its arms to the ocean and caught the golden harvest as it fell from its sister's grasp. No city, except Paris, surpassed it in population, none approached it in splendor. It became the commercial centre and banker of Europe; five thousand merchants daily assembled on its exchange; twenty-five hundred vessels were often seen at once in its harbor, and five hundred daily made their entrance into it. The manufactures of Flanders and the Netherlands had been noted for many generations, and now vastly increased and were distributed all over the world. The Netherlands, though the smallest, became the wealthiest nation of Europe. Then came the long-continued war with Spain, ending in the siege and fall of Antwerp and in the imposition of such taxation as no other country had ever endured. As Antwerp had grown on the ruins of the Hanseatic towns, so her fall became England's gain.

France and England.

In America, north of Mexico, neither silver nor gold had been found to tempt the Spanish and Portuguese. The larger portion of the northern Atlantic coast was one long sand beach, broken by great estuaries and the mouths of great rivers; the rest was rocky and rugged, the temperature generally cold, the land unfertile and barren. For these reasons North America was left to the French and English. The French claimed Canada and the whole of the territory of the United States save a narrow strip of land on the Atlantic coast. The French population was small and was made up principally of fur traders and half-breeds; Great Britain held New England, Virginia, and the Carolinas.

After the first fever of religious colonization had passed, about the commencement of the eighteenth century, there was scarcely any emigration from England to America and but little trade between the two countries. The population of North America was small, its commerce less, with little profit to the European merchants. The country possessed no peculiar advantages for the production of articles of value in foreign markets; there was nothing, therefore, to invite immigration or commerce.

The chief inducement to the English to navigate the Atlantic was the hope of capturing the treasure-laden Spanish galleons and the rich Spanish cities.

Sir Francis Drake, Sir Walter Raleigh, and other navigators, aided by Queen Elizabeth, with bands of buccaneers, refugees from all countries, though mostly Englishmen, explored the recesses of the Caribbean Sea, crossed the Isthmus of Panama, and launched their little vessels on the Pacific. In fifteen years they captured five hundred and forty-five treasure ships, sacked many towns, trained the English seamen, and laid the foundation for the navy of Great Britain.

The growth of English commerce was slower than that of Spain, Portugal or Holland, and it was not until the middle of the eighteenth century, or two hundred and fifty years after the discovery of America, that she entered upon that career which gave her the control of the ocean. Her commerce was built up by protective laws, founded on the Navigation Act of 1651, which prohibited foreign vessels from carrying to or from England the commerce of any country but its own. These laws were universally regarded as among the chief causes and most important bulwarks of the prosperity of Great Britain, and they were continued until English ships controlled the carrying trade of the world, and were not finally repealed until 1854.

The mechanical devices of Watt, Arkwright, and other great inventors gave to England that supremacy in manufactures which she has ever since retained. The French revolution a little later aroused the fear of the statesmen, merchants, and capitalists of England that the energy of the new republic would be as omnipotent in mercantile affairs as on the field of battle. They believed that France might regain the colonies and with them the commerce she had lost, and therefore England declared war against Napoleon, which was carried on almost continuously from 1793 to 1815. The shipping of the continent disappeared or was captured by the fleets of England; the colonies, and with them the commerce, of Spain and Portugal, Holland and France, passed to England; and though she is still burdened with the debt then created, she has never lost the commerce and carrying trade she then obtained.

The population of the colonies of Great Britain is about one-sixth of the entire population of the globe; and their territory comprises eighty per cent of the available temperate regions of the earth belonging to the Anglo-Saxon race.

The commerce of England has given wealth to her bankers and merchants, and employment to her artisans, ship-builders, iron-workers, miners and manufacturers. Her exports of produce and manufactures have increased five hundred per cent in fifty years, or from $356,000,000 in 1840 to $1,577,000,000 in 1890, and are carried by her ships to every quarter of the globe. Though dependent on America for her food supplies, these are moved in British ships. The commerce of the world pays tribute to the bankers of London and makes that city the money centre of the world. Her best market is India, and from India comes her largest imports; next to these from the United States.

India.

Egypt, Nineveh and Babylon in prehistoric times, Tyre and Sidon and Greece under Alexander, Carthage and Rome under the Cæsars, Venice and Genoa in the middle ages, Portugal and Holland, and lastly England, have drawn great stores of wealth from India.

From India science and literature were handed on to Europe, and from India has come the religion of more than half of the human race. For India the Spanish sailed westward; for India the Portuguese sailed eastward; Portugal was the first to reach the goal and obtain the prize. Greater riches have been drawn from India than from the gold and silver mines of America, since for all ages it has been the storehouse from which treasures were derived. Portugal held India from about 1500 to 1600. Ships brought the silks and precious stones of India to Lisbon, where they were sold to the Dutch and distributed by them through Europe. Spain conquered Portugal, and to avenge herself on Holland excluded her merchants from Lisbon. Then they sailed directly for India, dispossessed the Portuguese, and the commerce of India was for the next hundred years controlled by Holland.

Then for a short time India was divided between France and England, but under Lord Clive and Warren Hastings the possessions of France passed to the East India company, and when their charter expired it was made a province of the crown and the Queen of England became Empress of India.

Unlike Rome and Spain in their dealings with conquered nations, England gives a fair exchange for all she takes, and rules in India for India, giving a more stable and equitable government than India ever before enjoyed.

To-day Tyre, Sidon, and Carthage are known only by their ruins; the glory of Greece and Rome, of Venice and Genoa, has passed; the power of Spain and Portugal has waned, while India is developing a social, moral, and political prosperity, with wealth and commerce unknown in any former period of her history.

Suez Canal.

Much of the trade of India in ancient times passed through a canal connecting the Red Sea with the Mediterranean, the remains of which still exist, and efforts to reopen it have been made at different times by Egypt without success. In 1856 de Lesseps obtained concessions from the khedive for the Suez Canal, and commenced the work under the direction of the best engineers of Europe. De Lesseps applied to English capitalists for help, but they were deterred by Lord Palmerston, who said he "Would oppose the work to the very end." Mr. Stevenson, the engineer, supported Lord Palmerston, declaring that "The scheme was impracticable, except at an expense too great to warrant any expectation of returns." The emperor of France lent his name to the company, and large sums of money were raised in France; but the canal was constructed mainly by the money and laborers of Egypt. It was opened in 1869, and immediately English steamers began to sail through the canal, and the route around the Cape of Good Hope was almost abandoned. Other flags soon followed, and the commerce with India and the east, so long lost to Venice and the ports of the Mediterranean, was revived.

In 1875 Lord Beaconsfield purchased for England a controlling interest in the Suez Canal, and England now rules both Egypt and the canal. The vessels of all the maritime nations of the world are constantly passing through the canal, with the single exception of those of the United States.

Colonies.

The commerce of the great nations of the world has been principally with their colonies or dependencies, and from this commerce they have derived their wealth. The mother country in return for its real or nominal protection, and for its own aggrandizement, has restricted the commerce of her colonies.

The European nations adopted four classes of restrictions: —

1. Restricting the exportation of goods from the colony except to the mother country.

2. Restricting the importation of goods from foreign countries into the colonies.

3. Restricting the exportation or importation of goods excepting in ships of the mother country.

4. Restricting the manufacture even of their own raw products by the colonies. So strong was this feeling in England that even Lord Chatham declared in Parliament, "The British colonies of North America have no right to manufacture even a nail or a horseshoe."

Most of these restrictions have been removed, though the result still remains.

The Phœnicians, Carthaginians, and Greeks had colonies on the Mediterranean. The Romans conquered, and held as subjects, nations and empires. Venice and Genoa had colonies on the Black and Mediterranean seas. Spain and Portugal held as dependencies all Central America, South America, Africa, India, and the islands of the Pacific. The Dutch Republic and France planted colonies in India and America. England has colonies in every part of the world, and on her dominion the sun never sets.

Germany, France, Portugal, and Russia, appreciating the necessity of colonies for the extension of their commerce and for opening new markets for their manufactures, are planting colonies, France in Cochin China, Germany on the eastern and western coasts of Africa and the islands of the Pacific. Portugal, aroused to a new life, is determined to hold her remaining possessions in Africa; Russia is steadily adding to her dominion in Asia, and her railway from the Caspian Sea to Samarcand has opened in western and a part of central Asia a market for her manufactures and commerce hitherto supplied by Great Britain.

United States.

The United States is the only nation that has become great without colonies and without foreign commerce and shipping. Its vast extent of territory, where the east and west, the north and south, are separated more widely than the colonies of Tyre and Sidon or of Carthage and Rome from the mother countries; the great variety of climate, the fertile soil, its varied occupations and manufactures, and a widely distributed population, have created an enormous inland commerce and given that trade and wealth which other countries find in commerce and exchange with their colonies. Our population, wealth, internal commerce, exports and imports have increased at a more rapid rate than those of any other nation in a similar period. This is not due in any great degree to immigration, for our population has increased in no greater ratio since this immigration commenced than before, and experts believe that it would have been as large and more homogeneous without immigration. We had at one time a large foreign commerce, and our merchants were the first to establish direct trade with China and the East Indies; the Stars and Stripes were seen floating on every sea and flying in every harbor, and for years we were the second maritime nation of the world.

The commerce of the world passed from wooden sailing ships to side-wheel steamers, to iron and then to steel propellers; England was a worker in iron and machinery of every kind, we were not. The civil war came and hastened the day which was sure to come. Our shipping faded away faster than it had arisen, while that of Great Britain increased as rapidly as ours decreased. This was not owing to a decrease of our foreign trade, for during the last twenty years our exports and imports have increased more than twice as rapidly as those of Great Britain.[1] Eighty-seven per cent of these exports and imports are carried in British ships, consigned to English houses which have been established in every large port in the world, and the proceeds are usually remitted to the London banker.

Fortunately, our flag never disappeared from our inland waters and from our coasting trade; for foreigners are excluded from the coasting trade, even where the ports are fifteen thousand miles apart by water.

The substitution of steamers for sailing ships and of steel for wooden propellers, which took place from ten to twenty years ago on the ocean, is now going rapidly on upon our lakes. Where in 1886 there were but six steel propellers, now there are sixty-eight; and of 2,225 vessels on the northern lakes, 1,153 are steamers, 902 are sailing vessels. The action of Congress in providing for the construction and equipment of war vessels by competition has led our ship-builders within the last eight years to establish ship-yards and machine shops where the largest ships can be built, and we are now building as large and fast vessels of war as England. Our ship-builders claim that they can construct ships equal in carrying capacity, speed and strength to those of Great Britain, and at no greater cost; though they cannot be run so cheaply because our sailors are better housed, fed and paid than those of other nations. The day will surely come when commerce will make her last movement westward, when America, lying between Europe and Asia, with her boundless mineral and agricultural resources, her manufacturing facilities, her extended sea-coasts, will be the foremost nation and New York the commercial capital of the world.

Nicaragua Canal.

From New York to San Francisco by land is about 3,000 miles, by water it is about 15,000 miles; yet, notwithstanding the greater distance, freight is constantly sent by water. From San Francisco it is about the same distance by water to either New York or London. If a waterway could be opened across the isthmus of Panama from one ocean to the other, the distance from New York to San Francisco would be diminished more than one-half, and San Francisco would be over 2,000 miles nearer New York than London. The first proposition for canals connecting the two oceans was made in 1550, suggesting two routes, by Panama and Nicaragua; and explorations and surveys of both have been frequently made, and various attempts made for their construction.

The success of the Suez Canal induced M. de Lesseps to undertake the connection of the two oceans by the construction of the Panama Canal, believing that the tonnage passing through it would equal that of the Suez Canal. This work has not been successful; the canal remains unfinished, with no prospects of completion.

Several hundred miles north of Panama is the lowest continental divide; 148 feet above tide-water on the Pacific slope of this divide is Lake Nicaragua, connected by the river San Juan with the Atlantic; up this river and through this lake, some thirty years ago, was one of the regular ways of intercommunication, both for freight and passengers, between New York and California.

The Maritime Canal Company and the Canal Construction Company, organized by Americans, have obtained concessions from Nicaragua, and have made surveys for canal, slack-water, and lake navigation from Greytown on the Atlantic through Lake Nicaragua to Brito on the Pacific, a distance of 170 miles. A harbor has been opened at Greytown and considerable work performed on the canal. The Panama route had the great advantage of an open channel from ocean to ocean, whereas the Nicaragua route requires several locks to cross the divide; but Brito is some six or seven hundred miles nearer California than Panama, a saving in distance that will compensate for the delay in locking. The opening of this canal will be the greatest benefit that could be conferred upon our commerce and shipping.

Freights by water between New York and California are now so high that a large portion goes by railroad. The effect that this canal should produce will be evident if we consider the great difference in expense between land and water carriage. Rail rates between New York and Chicago are a trifle over six mills per ton per mile, while the ocean rates on grain to Liverpool in 1888 were about half a mill per ton per mile; and one mill per ton per mile, or three dollars per ton from New York to Liverpool, is said to be a fair rate, while the all-rail rate between New York and San Francisco averages from forty to eighty dollars per ton, according to the class to which the freight belongs. It takes from seven to ten days to go from New York to Liverpool, twice as long from New York to San Francisco by rail, thirty days by Panama, and one hundred and twenty days by the all-water route around Cape Horn.

The opening of this canal will therefore reduce the freight on goods between the east and west at least three fourths and possibly more. It will give us a free, easy, and cheap communication by water between the Eastern and Western States; our commerce will be built up, and the wealth and commerce of the Atlantic coast and the population of the States on the Pacific coast will be increased in a wonderful manner.

The opening of this route will give a demand for large steamships, and when we have such ships large ship-yards and machine-shops will spring up, and these alone are wanted to enable us to build and run ships on the Atlantic Ocean in competition with Great Britain. Then the prediction of Mr. Cramp will be fulfilled, that Englishmen will be asking one another, "Can we build ships as economically as they do in the United States?"

Modes of Conveyance.

The earliest transportation of merchandise was by caravans. The first caravan of which we have any certain account was that of the Ishmaelites and Moabites, who, while they were travelling from Gilead with their camels, bearing spices, balm, and myrrh to Egypt, bought Joseph of his brethren and sold him as a slave to Potiphar. These caravans were formed of merchants banded together for protection, under a guide and leader, sometimes numbering several hundred, with one thousand camels in a caravan. They travelled from seventeen to twenty miles a day, but only in the spring and autumn months. At night they stopped at caravansaries, where free lodging was furnished to men and beasts. In Turkistan and Arabia all trade and travel was by similar caravans until the railroad was opened across the desert by Merv and the Oxus to Samarcand.

Navigation was first by boat, and ages afterward by vessels. The earliest vessels of which we have any account were employed in carrying cattle down the Nile, and were propelled by sails and rowers. The vessels, at first small and with few rowers, were slowly increased in size and number of rowers until three, four, and even five banks of oars, one over the other, were used. They were often from 150 to 175 feet long, and from 18 to 26 feet in breadth, drawing from 10 to 12 feet of water, and sometimes carrying two hundred rowers and several hundred men. All these ships were without decks, whether sailing on the Mediterranean

[1] The exports of the United States have increased 112 per cent, the exports and imports 92 per cent; the exports of Great Britain 35 per cent, her exports and imports 37 per cent.

or Atlantic. They sailed by day, putting into harbor at night, and never losing sight of land unless driven by stress of weather. At first they sailed only with the wind, but by slow degrees they learned to tack; then decks were built over the stern and prow, leaving the mid-ships exposed to the high seas. This class of vessels, sometimes with banks of oars, continued until the middle of the last century. In the early part of the fifteenth century smaller but stronger vessels of better material were built for the voyages of discovery undertaken by the Portuguese. At this time also the mariner's compass was brought into general use, having been introduced from Arabia; eighty years later it found its way to England. Two of the vessels of Columbus were decked only at the prow and stern, and the three were manned by one hundred and twenty men.

The Armada of Queen Elizabeth was formed of merchant vessels fitted up as men of war, and not until the time of Charles the First were there any regular ships of war in England or, probably, in other countries.

Commerce was usually carried on by companies, with rules regulating the quantity of goods to be exported. so that the market should not be overstocked and unremunerative prices obtained. Sometimes the merchant was owner of the vessel, who adventured with his cargo and sailed in his own ship. The ships were constructed with little reference to speed, sailing forty or fifty miles a day.[1]

The steam engine came into use near the middle of the eighteenth century in England, and two generations passed before it was used on vessels. The first steamboat ran on the Hudson in 1807, in England in 1812. Then another generation passed before the ocean was crossed by the "Sirius" and "Great Western" in 1833. These ships sailed from seven to eight knots an hour. Ten years later iron ships were built; then came the propeller, the invention of Ericsson, followed by vessels built of steel, and lastly the "City of Paris" and "Majestic," carrying fifteen thousand tons of freight and sailing five hundred knots a day, or twenty knots an hour.

Until the present century all commerce between remote points was by water, excepting in the Roman Empire. After the downfall of Rome there was neither commerce nor travel and no use for roads, the cost of transportation even for a short distance exceeding the value of the goods.

The railroad was introduced about the same time into England and America, and was rapidly extended into every country. The steam-engine on land and water has revolutionized the methods of transportation and created a new commerce. "The movement of goods in a year on all the through routes of the world did not then equal the movement on a single one of our trunk lines of railroad for the same period." Formerly it cost ten dollars to move a ton of freight one hundred miles; now it can be moved thirteen hundred miles for the same sum. The grain and corn from our western lands, then not worth the transportation to the sea coast, are now sold in London, and our prairies yield to the western farmer greater profit than the grain lands of England yield to the farmer there. The land commerce created by steam probably exceeds to-day the commerce carried on the water.

The cost of moving freight by railroads varies greatly in different parts of the United States and in different countries. The highest cost west of the Rocky Mountains is two and a quarter times more than in some of our middle States. The average freight receipts per ton per mile in this country is $0.922, which is less than those of any other country, although the Belgian and Russian rates are not much higher. In England the rates are from fifty to seventy per cent higher than in America, and in the other countries of Europe higher than in England.

In England and America the railroads are operated by private companies in competition.

In France railroads are operated by private companies regulated by law, the country being divided among different lines of road. Lines are constructed by private companies and run at rates fixed by the government.

[1] The breadth was about one-fourth the length, and not until within forty years were the proportions of one-tenth or one-twelfth of the breadth obtained.

In Belgium and Germany the principal roads are owned and operated by the government.

Our system has yielded the best results to the people.

The commerce which was in olden times transported only twenty or twenty-five miles a day is now moved five hundred miles a day by water and eight hundred miles by land. Correspondence, then carried no faster than freight, is now borne by telegraph to the farthest ends of the world.

All these changes have taken place within a single generation; for our fathers could not travel any faster than Alexander or Cæsar. Steamships, railroads, and telegraphs within that time have transformed all commercial transactions and the methods of commercial business. Formerly eight months were required to execute an order in India or China and obtain the return; now one day is sufficient. These commercial changes caused a revolution in the modes of business, and were the main factors which produced the monetary disturbances of 1873, the effects of which we yet feel, so long has it taken the world to adjust itself to its new relations.

The Future of Commerce.

The commerce of the world originated in Asia; it was carried to Africa and thence to Europe, and from Europe to America. This movement can go no further westward, for on the other side of the Pacific is China, which has successfully resisted every attempt of the European to encroach upon her domains, and India with its teeming population of two hundred and fifty millions; so that America, the last of the continents to be inhabited, now receives the wealth of India and Asia pouring into it from the west, and the manufactures and population of Europe from the east. Here the East and West, different from each other in mental power and civilization, will meet, each alone incomplete, each essential to the fullest and most symmetrical development of the other. Here will be the great banking and commercial houses of the world, the centre of business, wealth, and population.

The end is not yet. Inventions are increasing in a geometric rather than an arithmetric progression. The limit of steam-power has not been reached, for with a high temperature in the steam-boiler the addition of a few pounds of coal increases the steam-power so greatly that we are unable either to control or to use it.

Electricity has just begun to offer new opportunities to commerce. We are no longer compelled to carry our factories to the water-power, for by the electric wire the power may be brought to the house of the operative, and we may again see the private workman supercede the factory operative. A few cars and small vessels are moved by electricity — the forerunner of greater things. We know little of this new agency, but its future growth must be more rapid and more wonderful than that of steam.

The secretary of the Smithsonian Institution (Mr. Langley) tells us that "before the incoming of the twentieth century, aerial navigation will be an established fact."

"The deeper the insight we obtain into the mysterious workings of nature's forces," says Siemens, "the more we are convinced that we are still standing in the vestibule of science; that an unexplored world still lies before us; and, however much we may discover, we know not whether mankind will ever arrive at a full knowledge of nature."

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.*

On request in advance, one hundred copies of the number containing his communication will be furnished free to any correspondent.

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

The Loup Rivers of Nebraska.

PERCEIVING by Professor Hicks's reply (March 4) to my comment (Feb. 19) on his essay on the Evolution of the Loup Rivers (Jan. 29) that I had in part misapprehended his meaning, I have corresponded with him in order to understand more clearly the share that he ascribes to headwater erosion and capture in the development of the present stream courses. As is not infrequently the case, there is more agreement than difference in our discussion.

My misapprehension arose as follows: In his essay of Jan 29, after speaking of headwater erosion and the subsequent capture or lateral abstraction of certain streams by this process, Professor Hicks wrote, "The latest robbery in the Loup system is that of the headwaters of the Wood River. Journeying down from the headwaters of the South Loup, one is impressed with the apparent continuity of its valley with that of Wood River, rather than with that of the South Loup itself below Callaway. It is obviously an instance of the lower, more easterly stream cutting through the divide and drawing to itself the headwaters of the higher one. This series of captures by lower tributaries is exhibited on a grand scale and in a mature form in the Loup system."

If the reader will refer to the first figure in Professor Hicks's essay, he may understand why I inferred from this sentence that the several other deflected streams, exhibiting the same relative parts as shown in the South Loup and Wood Rivers, constituted the "series of captures" in which the South Loup was "the latest robbery."

It now appears, however, that the head of Wood River was not precisely located in the figure referred to; and that its correction by Professor Hicks in his letter to me places it more as figured by Professor Todd in *Science* for March 11. As thus figured, it is distinctly placed in another category from the streams deflected eastward by flood-plaining.

Professor Hicks refers me to his article on "An Old Lake Bottom" in the second volume of the Bulletin of the Geological Society of America. Mention is there made of certain old valleys of Tertiary erosion, more or less obscured but not entirely concealed by lake sediments of later Tertiary deposition, by which the country is now covered. These old valleys are placed in the same category with the abandoned channel at the head of the Wood River, by which the South Loup is supposed once to have flowed to the Wood, as if headwater erosion by adjacent streams had in all these cases determined the abandonment of the old valleys. But it is still not clear why all these abandoned valleys must be regarded as having lost their former streams by lateral abstraction following headwater erosion. I perceive that the slopes indicated in Professor Hicks's figures are in the proper direction for such abstraction; but it is surprising to find that slopes of so moderate a measure of inclination suffice to give one stream an advantage over another, even to the points of abstraction of this kind. I shall be delighted if this is proved to be the case; for, if so, the process of abstraction and the accompanying rearrangement of divides may be regarded as of very extensive application. As ordinarily explained, the advantage that the capturing stream must possess is much greater than would be found in a region of horizontal and comparatively weak sediments, and of moderate inclination, such as Nebraska.

I shall therefore hope to have a fuller discussion of the problem from Professor Hicks, and an exclusion of other processes as well as a confirmation of the effective action of headwater erosion on so large a scale in producing these changes in Nebraska river courses.

The chief rearrangement of the Loup streams, as shown in Professor Hicks's diagram, being the product of down-stream deflection of the tributaries of a flood-plained river, I find in them a very satisfactory justification of a somewhat hazardous explanation offered in an essay on the Rivers and Valleys of Pennsylvania (Nat. Geogr. Mag., I., 1889, 241) for the down-stream deflection of certain tributaries of the Susquehanna in the central portion of the State. But in this case the flood-plain, by whose growth the tributaries were deflected, is a thing of the imagination. If it ever existed, it has been entirely worn away by the denudation following the later elevation of the region in Tertiary time; the deflected streams, maintaining their specialized courses after uplift, cut down their channel through the imagined flood-plain sediments, and thus became superimposed on the underlying strata, which they now deeply dissect and traverse in a highly inconsequent manner. Professor Todd's diagram gives further illustration of this kind of down-stream deflection of tributaries. All of the branches of the Platte are deflected before reaching the main stream; the Platte itself is turned down before joining the Missouri; so is the Niobrara.

In this connection I wish to suggest another cause besides the three mentioned by Professor Todd for the north-eastward turn of the Platte at Kearney; namely, the possible spontaneous deflection of the river from its previous more direct course, as, for example, along the Little Blue, by its own action in building up the plain over which it flowed. The rivers of the plains of India frequently change their courses in this fashion; the Hwang-ho devastates the plains of China for the same reason. May not the Platte have once had the same shifty habit? The Garonne, in south-western France, is a still more striking example of a spontaneous avoidance of its former course. Much of the waste borne out from the Pyrenees by the Garonne and its fellows now forms a flat, delta-like surface, of radial slope from the point where the larger rivers issue from the mountains; but, instead of pursuing a direct course northward, the Garonne turns sharply to the east at the foot of the mountains; while numerous small streams run down the slope of the radial alluvial deposit. Perhaps in the same way the Little Blue and the branches of the Big Blue Rivers may represent the old courses of the Platte, abandoned for a newer course of lower grade.

There are two other questions that I should like to ask of western observers. Is there generally perceptible a right-handed deflection of the rivers on the plains, as if in consequence of the earth's rotation? Can examples be given of the lateral abstraction of one stream by another on a slope of planation, after the fashion described by Gilbert in his report on the Henry Mountains some years ago? W. M. DAVIS.

Cambridge, Mass., April 7.

The Persistency of Family Traits.

THERE are one or two points bearing on the subject at the head of this article that were not mentioned by either of the writers in the issue of March 18. The first is that the mother in placental mammals tends to assimilate in respect to blood to the father, as the blood of the mother passes through the young *in utero* and therefore the strain of blood derived from the father is shared by the young with the mother. A study of family history carried on for almost twenty-five years shows that there is generally a running to what are called "family types" among the youngest of a numerous family, and the type is that of the paternal family. It is too well known to need argument that the mother frequently acquires diseases belonging to the father indirectly through the child she is carrying. It is also well known that an old couple tend to assimilate in facial and bodily appearance, and the change, as shown by numerous instances, is generally in the female, as the above facts would call for. We can see that each child in a family finds the mother more and more impregnated with the blood of the paternal house, and it is not strange if the children favor the family that gives them the name.

The other fact is that the pregnant mother is more readily influenced by whims than in any other state. From classical times to the present it has been the aim of those about a woman in such a state to make life as pleasant as possible. While we may no onger surround her with beautiful statues and other paraphernalia of a Roman household, we recognize that her whims may fix the character as well as permanently mark the coming child. We drive a gravid mare in a light wagon that the foal may be amenable to discipline. As the generality of married people associate more with the family that carries the name, it follows that the mother is affected by sympathy or antipathy for that family, and both lead her to dwell on the features and forms of its members, so that the child runs a good chance of bearing either or both. Birth-marks do not exist in fiction only, and though the bloody horse-shoe of Redgauntlet may be lacking, there are other signs to show the horror or antipathy of a terrified or whimsical mother. In a love match, the face of the father is reproduced, or, as the French proverb says, "The love child resembles the father." A union, therefore, of the two conditions noted above will cause the children to favor the race that carries the name rather than to run toward the spinster side, even were there nothing like reversions to the primitive type, and as family portraits show a uniformity that could not exist if the race obtained but its mathematical proportion of ancestral peculiarities, arguments based on the mathematics of the case avail little in the discussion.

EDWARD H. WILLIAMS, JUN.

Bethlehem, Penn., April 9.

BOOK-REVIEWS.

The Great Earthquake of Japan, 1891. By PROFESSOR JOHN MILNE, F.R.S., and PROFESSOR W. K. BURTON, C.E. With plates, by K. Ogawa. Yokohama, 1892.

IN these modern days when photography has assumed such an important part, not only in the artistic side of life, but in the work of scientific observation as well, it was inevitable that after any great natural occurrence like the Japanese earthquake of October, 1891, the camera should be employed to assist in preserving a correct record of its effects. Some of the pictures so taken have been reproduced in the European and American illustrated papers and have aided much in conveying to western readers an idea of the great destruction caused by this calamity; but none which the writer has seen can be compared to the beautiful series of pictures contained in the volume named above.

It is an oblong quarto, 29 cm. by 41 cm. in size, containing twenty-nine full-page heliotype copies of photographs and one map. All but three of the photographs were made by the authors for the Imperial University of Japan, and are copyrighted in its name. They are printed on a fine Japanese paper, which is itself a product of the very district shaken by the earthquake. The book is published by Lane Crawford & Co., Yokohama, but the press-work was done in Tokyo. It is prepared as a popular souvenir of the earthquake, and makes no attempt at any scientific discussion of the phenomena, the ten pages of introductory letter-press on earthquakes in general and the short explanation attached to each plate being mainly descriptive.

In nearly one-third of the plates the objects illustrated are the temporary shelters to which the inhabitants were driven. But in those which illustrate the ruined condition of the buildings and bridges, the excellent plates give such perfect details that many points of scientific interest can be seen and studied. This is especially true of the series of five views of the Nagara iron railroad bridge. This bridge consisted of five two hundred-foot spans of trussed girders, of which one span fell entire into the river's bed, carrying down with it one end of each of the adjoining spans, yet the pictures make plain that the girders themselves were so well put together that they are but little injured by their fall. Another view shows the approach to this bridge, where the embankment has entirely sunk away, leaving the rails and ties eighteen feet up in the air. At another place where the rails have been distorted into a serpentine form, the photograph shows three distinct horizontal flexures in which the rails are at least two feet out of their alignment. Other views again illustrate the crevasses, often several feet wide, by which the ground was riven, especially

CALENDAR OF SOCIETIES.

Philosophical Society, Washington.

April 9.—W. J. McGee, Illustrations of Isostatic Pressure; Bailey Willis, Illustrations of Appalachian Structure (with lantern views); Robert T. Hill, The Geologic Evolution of the Topography of Texas (with lantern views).

Geographical Club, Philadelphia.

April 6.—Henry Pettit, The Orient and the Occident.

Contemporary Club, Philadelphia.

April 12.—Frank Hamilton Cushing, Zuni Folk-Lore.

Oriental Club, Philadelphia.

April 14.—Rev. Dr. Marcus Tastion, Psalms 24th, 73d, and 90th; Talcott Williams, Note on Arab Geography.

Numismatic and Antiquarian Society, Philadelphia.

April 7.—Inman Horner, Lieutenant Gorger's Notes on Alaskan Indians. Exhibition Alaskan Objects.

Publications Received at Editor's Office.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Transactions, Vol. VII. New York, The Institute. 8°. 647 p.

DAVIES, CHARLES. New Elementary Algebra. Edited by J. H. Van Amringe. New York, American Book Co. 12°. 294 p. 90 cts.

FERREE, BARR. Christian Thought in Architecture. New York, from the Proceedings of the American Society of Church History. 8°, paper. 32 p.

KELLER, HELEN. Souvenir of the First Summer Meeting of the American Association to Promote the Teaching of Speech to the Deaf. 2nd ed. Washington, Volta Bureau. 4°, paper.

NATURAL SCIENCE. Vol I., No. 1., March, 1892. London and New York, Macmillan & Co. Monthly. 8°. 80 p.

NEWALL, JANE H. Outlines of Lessons in Botany. Part II.: Flower and Fruit. Boston, Ginn & Co. 12°. 396 p. Ill.

PARSONS, JAMES RUSSELL, JR. French Schools through American Eyes. Syracuse, C. W. Bardeen. 8° 136 p. $1.

PHILLIPS, MORRIS. Abroad and at Home. New York, Brentanos. 12°. 251 p.

SMITHSONIAN INSTITUTION. Annual Report of the Board of Regents to July, 1890. 8°. 842 p. Washington, Government.

along the embankments of the rivers, and others the ruins of the cotton spinning mill at Nagoya.

Altogether this album of plates is a most valuable contribution to the history of the earthquake, and may well merit a place on the shelves of anyone interested in Seismology. The first edition of 1,000 copies has all been sold at 6 yen (about $4.50), which is a very low price for such a volume; and a second edition is in preparation, perhaps ready for issue by this time. This will contain one or two additional plates, and will be sold at a somewhat higher price. C. G. R.

Princeton, April 9.

AMONG THE PUBLISHERS.

Edgerton Castle's important work on "Schools and Masters of Fence," which has heretofore only been obtainable in an expensive 4to form, will shortly be issued by Macmillan & Co. as a volume in the Bohn Library. The reprint will contain all the original illustrations and some additions in matter over the original work.

—G. P. Putnam's Sons add to their previous announcements the following: "Materialism and the Modern Physiology of the Nervous system," by William H. Thomson, M.D., professor of Materia Medica and Diseases of the Nervous System in the Medical College of New York. This volume, which will be illustrated, comprises the material (revised, with some additions) of two lectures recently delivered by the author before Columbia College, and at the McGill University, Montreal. Professor Freeman, whose sudden death a fortnight back has caused to be left unfinished a good deal of important literary work, had just before his death completed the proof-reading of the last pages of "The Story of Sicily," which he had prepared for the *Story of the Nations Series*. The preface to the volume, which he had not completed, will now probably be written by his son-in-law, Professor Arthur Evans.

SCIENCE

A WEEKLY NEWSPAPER OF ALL THE ARTS AND SCIENCES.

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SCIENCE

NEW YORK, APRIL 22, 1892.

THE LOAN COLLECTION OF OBJECTS USED IN WORSHIP.

THE ceremonies at the opening of the Loan Collection of Objects used in Worship at the Museum of Archæology of the University of Pennsylvania took place on the afternoon of the 16th of April, in the large hall of the library building, in the presence of a large audience of invited guests and members of the University Archæological Association. Addresses were made by Dr. William Pepper, provost of the University, the Rev. John S. MacIntosh, D.D., LL.D., the Rev. Dr. Marcus Jastrow, and Mr. Charlemagne Tower, president of the Department of Archæology. Dr. MacIntosh, in his address entitled "Musings in the Pantheon of the East," dwelt upon the evidences of the unity of the human race to be found in the various religions represented in the collection. Dr. Jastrow, in conclusion, said, "Few in number as yet are the universities which have endowed chairs for the history of religions; a beginning has been inaugurated by which to interest American thought in this special work. Collections of religious emblems like the one we are about to open to-day contain the way-marks on the roads and by-ways which the human family has been taking up to this day. As yet there exists in the world only one museum where these way-marks can be studied; it is the Musée Guimet in Paris. And our collection here is the first attempt of the kind in our country."

The collection is divided into sections, each of which was either arranged and described by a special student, or by the curator with the aid of native oriental scholars. Each section of the catalogue, a closely-printed octavo of 174 pages, is prefaced by a sketch of the religion to which it refers, while the details regarding each object comprised in the 794 catalogue entries are given in appended notes. The sections comprise Religions of Ancient Egypt, by Mrs. Cornelius Stevenson; Religions of India: Vedism, Brahmanism, Buddhism, and Jainism, to which Suamee Bhaskara Nand Saraswatee of Jodhpur lent valuable assistance; Religions of China, divided into the State Religion, Confucianism, Worship of Ancestors, Taoism, Buddhism, and Thibetan Buddhism, arranged with the aid of scholarly Chinese; The Religion of the Chinese in the United States, under which is to be found an almost complete collection of the idols, shrines, amulets, implements for divination, with incense, paper money, and offerings used by our Chinese residents, including two practical shrines with all of their appurtenances, one of the God of War and the other the shrine erected at the New-Year; Religions of Japan: Shintoism and Buddhism, collated with the aid of resident Japanese students; Mohammedanism, by Dr. Morris Jastrow, professor of Arabic in the University of Pennsylvania; Native American Religions, comprising the North-west Coast, United States, Mexico, Yucatan, San Domingo, and Peru, by Dr. Daniel G. Brinton; Religions of Polynesia, by Dr. Brinton; Religions of the Baulu Tribes of Africa, by Rev. Dr. Robert Hamill Nassau; and, in conclusion, a section devoted to charms and amulets.

The collection represents forty-five individual donors and lenders, besides several institutions and societies, including the Smithsonian Institution, Washington, D.C., the Numismatic and Antiquarian Society of Philadelphia, and the Board of Foreign Missions of the Presbyterian Church in the United States, whose Missionary Museum constitutes the nucleus of the exhibition. The plan of the Musée Guimet has in general been followed, but the collection has a much wider range than the great Paris museum, although inferior to it in point of intrinsic value and artistic beauty of the specimens, every object in the Guimet Museum being a gem.

The educational value of the collection has been the first thing considered, and whatever are its deficiencies, it is highly suggestive throughout, and an endeavor has been made to supply the notable gaps by means of notes in the catalogue.

The exhibition has been the means of bringing to light many objects of scientific importance, whose possessors were unaware of their significance and value, and making them available for the purposes of study. It marks an event in the history of scientific work in its special field in Philadelphia, where the study of the history of religions, the object of a highly successful course of lectures during the past winter under the auspices of the University Archæological Association, has lately received much attention.

THE BROOKLYN INSTITUTE BIOLOGICAL LABORATORY.

THE location of the Biological Laboratory, at the head of Cold Spring Harbor, is one of the most favorable on the coast. The country around is high and rolling, with abundant forests, glens, and small streams, affording most excellent hunting ground for every form of animal and vegetable life common to our climate. Just above the laboratory is a series of three fresh-water ponds, each fertile in its own peculiar forms of fresh-water life, and through which flows the water of Cold Spring Creek. Just below the Laboratory is the harbor of Cold Spring, divided by a sandy neck into an inner and an outer basin. These basins afford a great variety of marine life, and the channel between the inner and outer basins has a varied and vigorous growth of algæ, molluscs, and echinoderms. The outer basin has shallow flats, banks, and eel grass, sheltered pools, oyster-beds, and other favorable conditions for collection and study. The outer basin opens widely into Long Island Sound, whose coast is exceedingly varied in character for twenty miles in either direction.

The main Laboratory occupies the first floor of the New York State Fish Commission Building, and is a room thirty-six feet wide and sixty-five feet long, provided with ample light from every side. It is furnished with laboratory tables, aquaria, hatching-troughs, glassware, and all the apparatus and appliances required for general biological work. Into the Laboratory is conveyed a bountiful supply of the water of the Cold Spring for use in the aquaria and troughs. This water is pure, has the same low temperature throughout the year, and is the water used so successfully by the New York State Fish Commission in hatching and growing salmon, trout, and other food fishes. The Laboratory is also supplied with an abundance of salt-water, which is pumped up from the harbor into a reservoir, from which it runs into the Laboratory.

The station is provided with two small row-boats and a naphtha launch, together with nets, trawls, and dredges for use in collecting and dredging. The main Laboratory is furnished with both fresh and salt-water aquaria, with a Becker microtome and a Minot microtome, together with many smaller instruments and appliances. Near the main Laboratory is a photographic room, with a dark room and a work-room adjoining. These rooms are provided with a general photographic outfit, a photomicrographic apparatus, a heliostat, and the necessary appliances for practical photography.

Each student is provided with dissecting instruments, chemicals, and glassware to be used in the dissection, preparation, and study of tissues. Students who own microscopes, or who can borrow them for the summer, are respectfully requested to bring them to the Laboratory for their own individual use. Microscopes will be provided for those students who cannot provide themselves with instruments.

The New York Fish Commission very kindly grants the use of the main Laboratory room for biological study during the summer months, when it is not required by the work of the Commission.

The other buildings and the grounds used by the Biological Laboratory are the property of the Wauwepec Scientific Society of Cold Spring Harbor, and the use of them is generously donated by the Society for the benefit of the instructors, specialists, and students who are in attendance at the Laboratory.

A general course in biology adapted to meet the wants of those who desire to obtain a general and working knowledge of biology either for use in teaching or in preparation for special work will be given during the first six weeks of the session. It will consist primarily of laboratory study of specimens illustrating leading types of animal life. The practical work will be accompanied by lectures giving an outline of systematic zoology, for the purpose of showing the relations of the forms studied to other animals. The lectures will also touch upon various matters of general biological interest. The types studied will comprise forms of life represented in the waters of Long Island Sound.

Accompanying this course of laboratory work and lectures, instruction will be given in methods of mounting objects and in the preparation of microscopic sections. Opportunity will also be given for collecting and surface skimming.

A special feature of the Laboratory will be an extended course in the methods of bacteriological research. The course will consist of laboratory work on the culture and propagation of bacteria, the identification of species, and of lectures and demonstrations by the director. The number of students admitted to this course is limited, and only those who are well prepared by previous study and experience in biological or medical work will be admitted to the course.

Students who pursue the general course of instruction during the summer, and who have time for extra work, are given the instruction and facilities necessary to enable them to carry on special investigations, while those students who have already gained the knowledge and experience which is provided by the general course, will be permitted to give their entire time to special work. No special courses will be laid down in advance, but each student will be at liberty to arrange with the director of the Laboratory for such a course or courses as may be practicable.

Each lecturer will be provided with extra laboratory space in which to carry on his own private investigations so long as he shall remain at the Laboratory, and will not be called upon to give any instruction outside of his lectures and such directions for work as may accompany his lectures.

The Laboratory will open for the season on Wednesday, July 6. The regular session for students will continue from that date until Wednesday, Aug. 31.

The tuition fees will be, — for the full term, eight weeks, $25; for the first six weeks, $20; for the first four weeks, $15; for the last four weeks, $15.

The tuition is payable $10 on registration as a student, and the balance during the first week of attendance. Each student will be entitled to attend all the lectures delivered at the Laboratory, to the use of the Laboratory and its appliances, subject to the regulations established by the director and board of managers, and to all the facilities for collecting specimens which are possible with the launch and other boats provided by the Laboratory.

The number of students for the season of 1892 is limited to thirty. The Board of Managers reserve the right to admit as students only those whose training qualifies them to make the best use of the Laboratory and its facilities for study and research. Applicants for admission to the Laboratory should state what work in botany or zoology they have already done, and what course they would like to pursue the present season.

A good reference library will be placed at the service of students, and a collection of algæ will serve to guide students in marine botany. In addition to the regular lectures given in connection with the laboratory work, evening lectures will occur two or three times a week, illustrated by the aid of a magic lantern. The lantern is provided with a vertical attachment and with large and small cells, in which forms of life may be placed and their structure exhibited on the screen. A microscopic attachment to the lantern will enable lecturers to demonstrate points in minute anatomy, and a large collection of lantern slides of biological subjects will furnish the means for comparison of many allied forms and structures.

The evening lectures will be open to the public, and persons interested may secure admission to the entire course.

Arrangements have been made with residents at Cold Spring Harbor to provide very good and comfortable rooms, with board, a few minutes' walk from the laboratory, at rates varying between six and eight dollars per week.

A new dining-room has been provided close by the Laboratory, and excellent board will be provided to such officers and students as may choose to avail themselves of it at $5 per week. It is expected that a majority of the officers and students will board at the dining-room and take rooms at the residences near by. The expense in this case will be as before, between seven and ten dollars for board and room.

Accommodations can be secured at either of the large, excellent, and quiet hotels that overlook the harbor, and are fifteen minutes' ride by boat or carriage from the Laboratory, at rates varying between eight and fifteen dollars per week, according to the size and location of rooms. The hotels are known as the Glenada, Laurelton, and Forest Lawn.

Full information will be given concerning rooms and board to anyone who signifies an intention of becoming a student at the laboratory, and both board and room may be engaged in advance by application to the director of the Laboratory.

For further particulars inquire of Professor Franklin W. Hooper, Brooklyn Institute of Arts and Sciences, N.Y., or of Professor Herbert W. Conn, Wesleyan University, Middletown, Conn. Applications for admission as students should be sent to the Institute.

THE MARINE BIOLOGICAL LABORATORY.

The corps of instructors this year consists of Dr. C. O. Whitman, director, professor of zoology, Clark University; editor of the *Journal of Morphology;* H. C. Bumpus, associate professor of zoology, Brown University; E. G. Conklin, professor of biology, Ohio Wesleyan University; Pierre A. Fish, instructor in physiology and anatomy, Cornell University; Jacques Loeb, professor of physiology, Bryn Mawr College; W. A. Setchell, instructor in botany, Yale University; Sho Watase, assistant in animal morphology, Clark University; W. M. Wheeler, assistant in animal morphology, Clark University; Ryoiche Takano, artist; G. M. Gray, laboratory assistant; J. J. Veeder, collector.

In addition to the regular courses of instruction in zoology, botany, and microscopical technique, consisting of lectures and laboratory work under the direct and constant supervision of the instructors, there will be a number of lectures on special subjects by members of the staff. A course of lectures in embryology will be given by Professor Whitman; in biological physiology, by Dr. Loeb; and two or more courses in invertebrate zoology, by Dr. Bumpus and Dr. Wheeler.

There will also be ten or more evening lectures on biological subjects of general interest. Among those who may contribute these lectures and take part in the discussions upon them may be mentioned, in addition to the instructors above named, the following: Dr. H. Ayers of the Lake Laboratory; Professor H. H. Donaldson, Clark University; Professor William Libbey, Jun., Princeton College; Dr. Warren P. Lombard, Clark University; Professor Charles Sedgwick Minot, Harvard Medical School; Professor E. S. Morse, Salem; Professor H. F. Osborn, Columbia College; Professor W. T. Sedgwick, Massachusetts Institute of Technology; Professor E. B. Wilson, Columbia College.

The Laboratory is located on the coast at Wood's Holl, Mass., near the Laboratories of the United States Fish Commission. The building consists of two stories — the lower for the use of teachers and students receiving instruction, the upper exclusively for investigators. The Laboratory has aquaria supplied with running sea-water, boats, a steam launch, collecting apparatus, and dredges; it is also supplied with reagents, glassware, and a limited number of microtomes and microscopes. By the munificence of friends the library will be provided henceforth not only with the ordinary text-books and works of reference, but also with the more important journals of zoology and botany, some of them in complete series.

The Laboratory for investigators will be open from June 1 to Aug. 30. It will be fully equipped with aquaria, glassware, reagents, etc., but microscopes will not be provided. In this department there are twenty-four private laboratories supplied with aquaria, running water, etc., for the exclusive use of investigators.

Owing to the growth of the Laboratory and the great demand for tables, the trustees have voted to enlarge the present building so that a spacious new wing will be ready for use on July 1. Those who are prepared to begin original work, but require supervision, will occupy tables in the general laboratory for investigators, paying for the privilege a fee of fifty dollars. The number of such tables is limited to ten. An elementary course in investigation will be introduced this season, designed to meet the needs of those who have completed the general courses in the Students' Laboratory. Definite problems of limited scope will be assigned and worked out as a means of training in the ways and methods of research. The fee for this course also will be fifty dollars, and the number of tables will likewise be limited to ten. For the completion of any considerable piece of investigation, beginners usually require from one to three full years. It is not expected, therefore, that the holders of these tables will finish their work in a single season. The aim is rather to make a secure beginning, which will lead to good results if followed up between sessions, and renewed, if need be, for several successive years.

The Laboratory for teachers and students will be opened on Wednesday, July 6, for regular courses of seven weeks in zoology, botany, and microscopical technique. The number admitted to this department will be limited to fifty, and preference will be given to teachers and others already qualified. By permission of the director, students may begin their individual work as early as June 15 without extra charge, but the regular courses of instruction will not begin before July 6. Though more advanced students who may wish to limit their work to special groups will have an opportunity to do so, the regular course in zoology, in charge of Professor Bumpus, will embrace a study of the more typical marine forms and elementary methods of microscopical technique. Mr. W. A. Setchell will have charge of the work in botany. The tuition fee is thirty dollars, payable in advance. Applicants should state whether they can supply themselves with simple and compound microscopes. Microscope slides, dissecting and drawing instruments, bottles, and other supplies, to be finally taken from the Laboratory, are sold at cost. Further information, if desired, may be had by addressing Professor Hermon C. Bumpus, Wood's Holl, Mass.

Applications for places in either department should be addressed to Mrs. Anna Phillips Williams, secretary, 23 Marlborough Street, Boston.

Rooms accommodating two persons may be obtained near the Laboratory, at prices varying from $2 to $4 a week, and board from $4.50 to $6. By special arrangement, board will be supplied to members at The Homestead at $5 a week.

A Department of Laboratory Supply has been established in order to facilitate the work of teachers and others who desire to obtain materials for study or for classes. It is proposed to furnish, e.g., certain sponges, hydroids, starfishes, sea urchins, marine worms, crustaceans, mollusks, and vertebrates, preserved in good condition, at fair prices. Orders for the coming college year should be given as soon as possible. Circulars giving information, prices, etc., may be obtained by addressing the Department of Laboratory Supply, in care of the secretary.

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 of Buzzard's Bay, and may be reached by the Old Colony Railroad (2½ hours' from Boston), or by rail and boat from Providence, Fall River, or New Bedford. Persons going from Boston should buy round-trip tickets ($2.85).

The annual report of the trustees, containing an account of the organization and work of the Laboratory, may be obtained from the secretary.

HOMOPTERA INJURIOUS TO GRASSES.

AMONG the many insects that are destructive to the grasses the little leaf-hoppers take a very prominent place, and the writer is of the opinion that, although their work is often or for the most part entirely overlooked, they are really responsible for much of the damage accredited to other insects or to drought. Studies carried on during the last few years, and which have been reported in bulletins of the United States Department of Agriculture [1,2] and of the Iowa Experiment Station,[3,4] lead to the opinion that from one-fourth to one-half of the crop is lost regularly as a result of their work, and that a large part of this loss could be saved by the adoption of remedial measures. It seems also, at least for blue-grass in Iowa, that the common affection known as "silver-top" is to be charged against these same insidious enemies.[5]

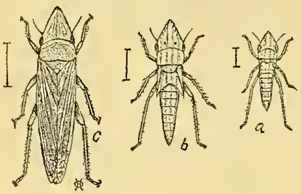

FIG. 1.
Diedrocephala mollipes (Original).

While there are many different species concerned in this work, many of which have still to be studied, and representing the families *Jassidæ*, *Cercopidæ*, and *Fulgoridæ*, the most numerous, and I think the most destructive, fall in the family *Jassidæ*, and a few of the more common ones may be enumerated here.

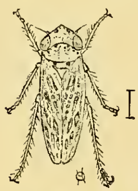

FIG. 2.
Deltocephalus inimicus (Original).

Diedrocephala mollipes is a grass-green species about one-third of an inch in length, and its general form, as well as the larva and pupa are shown in the accompanying figure. It occurs abundantly all over the country, but may be noticed more abundantly some seasons than others, and it shows a preference for ground that is moist rather than for very dry localities.

A quite similar species, *Diedrocephala noveboracensis*, is also quite abundaut and widely distributed, but seems to occur more especially around the borders of thickets and in grassy woodland.

Perhaps the most abundant and widely distributed species of all is the *Deltocephalus inimicus* of Say. Its work ranges all through the season, and it may even be found on warm days in winter.

The insect is nearly a fourth of an inch in length and of a grayish color, the most distinctive marks being the black dots on head, front portion of thorax, and on the scutellum; two on each, as shown in the accompanying figure.

Another species which occurs, at times in immense numbers, is the *Deltocephalus debilis* of Uhler. This is smaller than the preceding species, but without a careful examination may be very easily confused with it. It is quite uniform in color, and without the black dots characteristic of that form. Its distribution is probably very wide, though it has not as yet been reported from as many localities as the preceding species.

FIG. 3.
Deltocephalus debilis Uhl.
(Original.)

Aside from these especially abundant species there are many others belonging to the genus *Deltocephalus*, which seem to be confined to grasses as their food plant. *D. sayi*, *D. harrisii*, *D. melsheimerii*, and others having been taken in greater or less abundance in sweepings from grass.

Cicadula exitiosa Uhler was first described as a wheat pest, but it has proven a general grass feeder, and must be enumerated among the species affecting this crop. It is about two-tenths of an inch in length, of a brownish color, and the wings are quite distinctly marked with dark veins. The figure shows its form and the arrangement of the markings of the body.

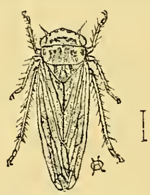

FIG. 4.
Cicadula exitiosa Uhl.
(Original.)

Agallia sanguineolenta Prov. is an interesting little species, often secured in grass and conspicuous in very early spring, as the adults can be seen in great numbers under the grass or, on warm days, hopping about on the leaves. It has proved, however, to favor clover as its food plant, and probably feeds on grass only during fall, winter, and early spring. It is about one-eighth of an inch in length, quite broad, about half as wide as long, and marked with numer-

[1] Bulletin No. 22, Division of Entomology, United States Department of Agriculture, pp. 20–41.
[2] Bulletin No. 23, Division of Entomology, United States Department of Agriculture, pp. 58–59.
[3] Bulletin No. 13, Iowa Experiment Station, pp. 95–101.
[4] Bulletin No. 15, Iowa Experiment Station, pp. 258–261.
[5] Proceedings of the Society for Promotion of Agricultural Science (1890).

ous dark blotches and short stripes, especially on the wings. This species appears to be double-brooded in the latitude of Iowa, though it is possible that three broods may occur.

The habit these insects have of hopping into the air on the least disturbance renders them open to direct attack with the "hopper-dozer" principle, which has been used so extensively in the contests with the Rocky Mountain Locust.

We have found, however, that a very simple plan of using this principle is the most effective in securing the leaf-hoppers. It consists in coating the upper surface of a sheet of sheet-iron with coal tar, attaching cords at either end, and also in the centre if it is very long, with which to draw it,

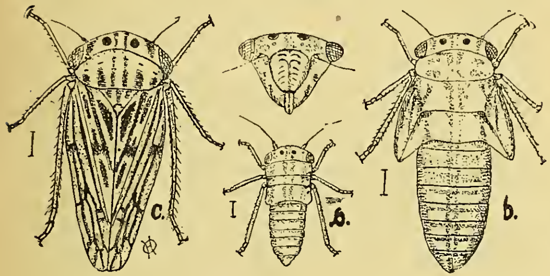

FIG. 5.

Agallia sanguinolenta: A. larva; *B.* pupa; *C.* imago, and front view of head of imago. (Original). Size lines are a little too long.

and then it is drawn over the lawn or pasture at a moderate walk by a boy or man at each end.

As soon as the sheet becomes covered with hoppers so that all are not held when they strike the pan a new coat of tar is applied. On an extensive scale this can be used at a cost of but a few cents per acre, and is applicable to large pastures and meadows. Upon lawns and pastures the treatment may be applied at any time when the hoppers appear numerous, but in meadows it is not applicable while the grass is in bloom on account of the accumulation of pollen on the sheet. In general, the best time to apply it is in early May and again, if hoppers are present, in summer, directly after the hay-crop has been secured. HERBERT OSBORN.

Ames, Iowa.

ASTRONOMICAL NOTES.

THE following is an ephemeris for the comet discovered by Denning on March 18. The epoch is for Berlin Midnight: —

	R.A. h.	m.	s.	Dec. °	′
April 25	2	18	44	+ 58	5.8
26		23	16	57	53.7
27		27	43	57	41.4
28		32	5	57	28.8
29		36	23	57	15.9
30		40	36	57	2.8
May 1		44	45	56	49.5
2		48	49	56	36.0
3		52	49	56	22.2
4	2	56	45	56	8.3
5	3	0	37	55	54.2
6	3	4	24	55	54.2
7	3	8	8	+ 55	25.6

This comet is now increasing its distance from the earth, but in the autumn the comet will again approach the earth, and observations will be possible far into next December.

The following is an ephemeris for the comet discovered on March 6 by Dr. Swift of Rochester, N.Y. The epoch is for Berlin midnight: —

	R.A. h.	m.	s.	Dec. °	′
April 25	22	14	21	+ 16	10.0
26		17	30	16	57.9
27		20	37	17	45.0
28		23	42	18	31.2
29		26	46	19	16.6
30		29	48	20	1.2
May 1	22	32	49	20	44.9
2		35	48	21	27.8
3		38	46	22	9.8
4		41	42	22	51.0
5		44	36	23	31.4
6		41	29	24	11.1
7	22	50	20	+ 24	50.0

These ephemerides are taken from No. 3,082 of the *Astronomische Nachrichten.* That for comet Swift was computed by Dr. Lamp, and that for comet Denning by Dr. Schorr.

The new star in Aurigæ has now become so faint that it can be observed only in the larger telescopes. It is fainter than the 13th magnitude. G. A. H.

NOTES AND NEWS.

MR. G. C. GREEN records in *Nature Notes* for April a curious reminiscence with regard to a pair of jackdaws kept by him at Modbury Vicarage, South Devon, about twenty years ago. They had been taken from the nest, and during the first summer their wings were slightly clipped. After this their wings were allowed to grow, and they lived at full liberty in the garden. They were perfectly tame, and would come at call and feed out of the band, would come into the house, and in the morning knock at the windows to ask for some breakfast. In the spring they used to fly away and join their wild companions, make their nests, and rear a family; but when this was over they came back to the garden again, fed from the hand, and were as tame as ever. But the curious thing was, that after one or two seasons they brought another jackdaw with them, presumably the young of one of them, which was just as tame as themselves, although nothing had ever been done to tame it, so that it was impossible to tell which were the original favorites, and which was the new one. Moreover, when after a few years one of these jackdaws was accidentally killed, another was brought by the other two.

— A Seaside Laboratory of Natural History, in connection with the Leland Stanford, Jun., University, will be opened during the coming summer at Pacific Grove, Cal., on the Bay of Monterey, about half-way between Monterey and the Point of Pines. This laboratory will be for the purposes of investigation in the life-history of the marine animals and plants of this coast. It will be under the direction of Professors Gilbert, Jenkins, and Campbell of the chairs of zoology, physiology, and botany respectively. It will be open to naturalists and others wishing to make special investigations in the anatomy or life-history of animals and to teachers of natural science. For further details those interested may apply to any of the directors at Palo Alto, Cal.

— In a discussion on diphtheria, published in the *British Medical Journal* for Sept. 19, 1891, Dr. Russell cited several instances in which steam had seemed to be an active factor in the propagation of the disease. Hot water and steam from a brewery were introduced into some old cesspools and evidently waked into activity germs which, if undisturbed, would have remained dormant.

— A new edition of S. Dana Horton's "Silver in Europe" will be published immediately by the Macmillans. The author has made some additions of importance to this edition in view of the present attitude of Congress on the question of free silver.

SCIENCE:

A WEEKLY NEWSPAPER OF ALL THE ARTS AND SCIENCES.

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Attention is called to the "Wants" column. It is invaluable to those who use it in soliciting information or seeking new positions. The name and address of applicants should be given in full, so that answers will go direct to them. The "Exchange" column is likewise open.

For Advertising Rates apply to HENRY F. TAYLOR, 47 Lafayette Place, New York.

CURRENT NOTES ON ANTHROPOLOGY.—IV.

[*Edited by D. G. Brinton, M.D., LL.D.*]

The Study of Jargons.

ONLY lately have linguists awakened to the extreme value of the study of jargons, and of hybrid and mixed languages. The fact is that in such we have the nascent condition of speech, the parturition of language, caught in the act. The phonetic and grammatic laws we see at work in the formation of a jargon are the same which have given to all existing tongues their form and idealogy.

The linguist to whom we owe the most in this new field is Hugo Schuchardt of Gratz. His works, published by the Imperial Society of Vienna, have presented especially the mixed dialects arising from the intermingling of Spanish and Portuguese with the native tongues of Insulindia. His analyses of them are masterful, and may justly serve as models for all similar researches.

More interesting to American readers is the recent publication of Dr. Karl Lentzner of Berlin, "Wörterbuch der englischen Volkssprache Australiens." It is in English in spite of this German title, and presents glossaries of Australian, Anglo-Indian, Pidgin English, West Indian and South African words. He adds an appendix, with numerous examples, and a discussion of these curious forms.

The book offers racy material for a magazine article, is full of quaint and humorous expressions, and tempts to numerous extracts. But it is enough to name it here, that it may not be overlooked by those who are interested in "Americanisms," folk-lore, slang, and such developments of language.

The Lotos-Eaters and the Troglodytes.

There is something peculiarly attractive in following the ancient Homeric voyages by the light of modern science. Who were the "mild-eyed, melancholy Lotus-Eaters," who dreamily strolled their island shores? Who the Troglodytes, cave-dwellers, speaking a strange language, which Herodotus compares to the squeaking of rats?

Two recent articles enables us to answer these questions satisfactorily. The one is by Dr. E. T. Hamy, in *L'Anthropologie;* the other by Rudolf Fitzner in the *Globus* (Band lxi.). The Lotos Isle was undoubtedly the island of Djerba, at the southern entrance to the Gulf of Gabes (north latitude 33° 40′). Its population is of unusually pure blood, and presents a fine example of the native blonde type of Northern Africa. The complexion is a full white, or slightly reddish, the head short, the face round, the nose straight, the lips thin. In other words, they are entirely similar to the Kabyles of the Djudjura, and the Rifians of Morocco. All three belong to the true Berbers, and speak near dialects of the same tongue.

The Troglodytes are of the same blood. They also are Berbers, of the stem of the Matmâta, living in the mountainous region between the Gulf of Gabes and the great salt lagoon, the Schott El Djerid. There they construct their strange, boat-shaped, cave-dwellings, just as they did in the days of Sallust and Herodotus and long before.

It is interesting to note that Fitzner (who adds a good ethnographic map of the regency of Tunis) recognizes the probable ethnic identity of the Berbers, Iberians and Etruscans,—a relationship which I believe I was the first to maintain.

A Native Maya Historian.

One of the most interesting documents relating to the history of America in the sixteenth century is a narrative of the Spanish conquest of Yucatan, written in his native language by a chieftain of one of the subjugated Maya tribes. The original text was published complete for the first time in Vol. I. of the "Library of Aboriginal American Literature" (Philadelphia, 1881), with an English translation. It merited, however, a much more complete analysis than was there given it, and this it has lately received from the competent hand of the eminent linguist, the Count H. de Charencey. Under the title, "Chrestomathie Maya d'aprés la Chronique de Chac-Xulub-Chen," he gives us an octavo volume of 301 pages containing the original Maya text with an interlinear translation in Latin, an exhaustive grammatical analysis, and a complete Maya-French vocabulary.

M. de Charencey very justly remarks that there is scarcely any other American language which presents so much interest as the Maya, in view of the high civilization of the people who spoke it, as well as its own linguistic traits. His excellent "Chrestomathie," therefore, should be obtained by all our leading libraries. It is published in Paris, Librairie C. Klincksieck, 11 Rue de Lille.

Dr. Topinard's Latest Work.

All who know anything about the literature of anthropology are acquainted with the works of Dr. Paul Topinard, and will acknowledge that there are none better on physical anthropology. The latest from his pen is "L'Homme dans la Nature" (Paris, 1891), a title which cannot be considered a very fortunate one, as it is difficult to imagine where else man could be than in nature. But let that pass. The interest of the volume lies in the more pronounced position which the author takes on the theory of human evolution, or, as the French prefer to call it, transformation. This theory is undoubtedly less popular in France than it was ten years ago, a change mainly owing to direct and indirect clerical influence; and it is therefore gratifying to find an eminent teacher like Topinard, boldly pronouncing in its favor, and declaring that it is the only possible theory adequate to explain known facts in the physical history of the human species.

The author makes frequent reference to his larger work "Eléments d'Anthropologie Général"; but the instructions for practical observations and the abstracts of the results of other investigators furnished in the present much smaller volume, will be sufficient to satisfy those students of the subject who feel themselves somewhat appalled by the nearly twelve hundred closely printed pages of the "Eléments."

Some Native Brazilian Tribes.

A model ethnographic study is that of some Brazilian tribes by Dr. Paul Ehrenreich, published in the second volume of the *Veröffentlichung aus dem Königlichen Museum für Völkerkunde zu Berlin.* He takes up the Karaya stock on the river Araguaya, and some tribes, the Paumari, the Yamamadi and the Ipurina on the Purus River. His descriptions meet all our requirements except in the important matter of language. This he no doubt designedly omits; though he mentions that among the Karaya the men and women have separate dialects, rarely, however, radically different words.

Of these little-known peoples he describes the costume, house-building, methods of obtaining food, tools, and weapons, etc. It is curious to note the love of the Karayas for taming animals. "Their villages resemble menageries." Dogs, fowls, cats, peccaries, parrots, even turtles, alligators and tapirs, meet the astonished traveller. The native does not look upon them as "lower animals," but quite on the same plane of existence as himself, and as his friends and companions.

The history and extension of the tribes are defined, and a number of admirable photogravures set forth truthfully to the eye their physical characteristics.

A MACHINE FOR CHURNING FRESH MILK.

In Bulletin No. IX. of the Delaware experiment station (Newark, Del.,) are given the results of a series of experiments made to determine the practical value of the butter extractor, a machine with which butter may be made directly from the freshly drawn milk.

In principle this machine resembles the DeLaval separator, which has now come into general use in creameries and large dairies, by which the cream is separated from sweet milk by centrifugal motion, but the butter extractor goes a step farther, and not only separates but churns the cream.

The machine operated with was made by an American company. It was found to require considerable experience to operate it successfully, and the tests upon which the station's comparisons are based were made under the personal supervision of the manufacturers of the machine. The results were that it was found that while the separator and churn obtained 93.34 pounds of butter out of every 100 pounds in the milk, the extractor obtained but 84.60 pounds, a loss of 8.74 pounds, and the butter thus obtained was of such quality that it could not be sold in competition with butter made from ripened cream.

In summing up the results of his tests Professor Penny, the chemist of the station says: —

"As to the relative expense of running in the one case the extractor alone and in the other the separator and churn together, it is doubtful if a creamery having only one machine would save anything in the number of hands employed, while in larger establishments the loss, greater by 8.74 per cent, caused by the extractor is heavier than the saving in wages. On a daily business of five thousand pounds of milk this deficiency is equal to fifteen or seventeen pounds of butter, yet such a business with the separator and churn need not employ more than two men, and the extractor could hardly employ fewer. The expense for power, etc., is nearly the same in the two cases. It must also be considered that while the separator requires the milk to be previously heated during much of the year—a simple and cheap operation—the extractor requires it to be cooled, at least in warm weather, and this calls for a greater supply of cool water or of ice—a decided disadvantage and in some creameries an unwarranted expense.

"Hence one feels justified in concluding that, if the quality of the butter be left out of the account, the extractor at present offers no substantial advantage that is not outweighed by defects, and that it would not allow any saving in expense over the process it is designed to supplant.

"Run as a separator alone under good conditions, this machine ought to give most excellent results, though in common with the DeLaval, and doubtless others, it varies greatly in skimming power, from causes that are partly unknown. As a skimmer it may be considered strictly first-class.

"Although the extractor appears unfavorably in comparison with a much older method, it cannot but be regarded as a marvel of inventive and mechanical skill. The surprise is in the first instance that it should do its work at all, and then, even though it be found wanting, that it should do its work so well. It is brought at the start into competition with a highly perfected machine and a method thoroughly understood from many years of experience. Its shortcoming under the severe test to which it is obliged to submit ought not to be cause of disappointment; there is room rather for encouragement, because it has done so much. Its future development is probably a question of the relative merits of sweet-cream butter and sour-cream butter.

"If experience and an educated taste shall finally favor the former, the extractor may be expected to take the place of the separator and the churn. But unless the decision shall fall in that direction, it is doubtful if the new device ever comes into general use."

It should be added to the foregoing that the comparison was made with the most perfect method of separating cream from milk now known. Had the extractor been compared with the old method of raising cream, the outcome would have been less unfavorable, as the separator gets out more cream than can be raised by gravity.

THE HIGHER EDUCATION OF THE DEAF.[1]

National Deaf-Mute College,
Washington, D.C., April 1, 1892.

A. L. E. Crouter, A.M., Principal:

My Dear Sir.—Your suggestions have received my most serious consideration. Allow me to thank you for the assurances of your friendly regard for the college and your appreciation of the value of the work it has already done. More grateful to the officers of the college than any written words could be, is the record of your

[1] Reply of President Gallaudet to the letter by Principal Crouter published in Science for April 8. Reprinted from the Silent World.

past efficient support of its work by the sending of a large company of students to it well prepared to enter and to profit by its advantages.

The proposal that the college should provide oral recitations for students that have been able to engage in such recitations in the schools in which their preparation for college has been completed, appears at first glance to be a very natural and proper one. A full study of the subject, however, discloses objections which to many minds will seem very serious. First of all should be considered the expense of carrying your suggestion into effect, not for a single year only, which would be small, but for the five years of the college course, which is quite another matter. The time and strength of the professors now at the command of the college are fully consumed with the duties at present assigned to them, and were separate oral recitations provided for orally taught members of each class, a complete duplication of the faculty would be demanded, and this not only as to numbers, but also as to ability, qualification, and experience. Such an increase of our teaching corps would involve an additional annual expense of at least ten thousand dollars.

The whole force of your suggestion rests, if I mistake not, on the statement that the pupils of oral schools "hesitate, and object, and refuse, when directed to Kendall Green, not because it is not a good school, nor because its professors are not competent men, but because of a well founded fear that that which they have spent much time and labor in gaining, namely, their speech and their ability to read speech, may be very seriously impaired" by the lack of oral recitations in the college. Now I will lay no stress, as many would, on the admission made in stating this point, that the speech and power to read the lips of others, gained only at great cost by the orally taught deaf, are possessions which may easily be lost; for my experience leads me to have much more faith in the security and permanence of these valuable acquisitions than you and Mr. Greenberger seem to enjoy, and my reasons for this stronger faith will presently appear.

It is not true, as the uninformed reader would infer from your letter, that the orally taught deaf of the country have never enjoyed the advantages of the college. Pupils from the Clarke Institution, from the Boston Day School, from private oral schools, from Mr. Greenberger's school, and last, but not least, a pupil who had for several years the special training of Professor Alexander Graham Bell, have been connected with our college for longer or shorter periods, one of them graduating with honor from our scientific course. None of these students enjoyed the advantages of oral recitations in the college. They had no special teaching in speech or lip-reading. They did, however, have considerable practice in speech while connected with the college.

No complaints came to me from these pupils, nor from any of their friends, while they were with us or after they had left us, that their powers of speech and lip-reading were even temporarily, much less permanently, impaired by their connection with the college. The father of one of Mr. Greenberger's pupils, who was for two years a student here, writes, under date of March 29, 1892: "In reply to your inquiry I desire to say that H. did not speak quite as well on his return, perhaps because that at college he had not as much chance to use his lips as he did while at school in New York, but since he is home, our conversation at home, as well as in our business with him, is so frequent, that I am happy to say he speaks as well and as understandingly as ever."

The father of another of Mr. Greenberger's pupils who pursued our full scientific course, taking the bachelor's degree, says in a letter just received: "I do not think my son's power of speech and ability to read the lips were injured in the least by his taking a course in your institution."

Four others of the orally taught pupils to whom I have just referred have informed me within a few days that, on the testimony of their friends, they experienced no permanent injury to their powers of speech and of lip-reading in consequence of their connection with the college. And the friends of two of these thought their speech improved while they were in college.

Now, in considering the cases of these orally-taught pupils to whom reference has been made, it must be kept in mind that they were all connected with the college at periods when no instruction in speech and lip-reading was afforded to any student. And yet it appears that not one of these young people, representing as they did the leading oral schools of the country, suffered any permanent injury to their powers of speech and lip-reading while students here. What more convincing proof could be given that the "fears" of the oralists voiced in your letter are not "well-founded?" And if these fears are justly dissipated by the records of times when no articulation teaching was afforded in the college they surely need be accorded little weight at present, when ten instructors are actively engaged in giving daily lessons in speech and lig-reading to the students of the college. There are those whose opinions are entitled to respect, who believe that the plan put in operation the present year by the college for preserving and improving the speech of all its students, including the orally taught, will produce more satisfactory results than the one proposed by you, which would involve, inevitably, an increase of ten thousand dollars in the annual expenses of the college, and this for the sake of a number of students not likely to be more than twenty-five. And should the alternative you press in your letter as, apparently, an ultimatum, be followed, of establishing a college especially for the orally-taught deaf, the increase in the expense of their higher education would be much greater than even the figure I have named. We are trying an experiment, the results of which are thus far encouraging, to continue which will involve no increase of expense, while you urge a scheme certain to be very costly, and by no means sure to give better results. In view of the unprecedented facilities for oral teaching newly offered in the college the present year, and which will be continued next year, will it not be safe to intrust orally-taught pupils to us for a year or two, or at least until it can be demonstrated that our way of preserving and improving their speech is a failure? For if it prove a failure, no one will be readier than I to accept such a result, and to advocate what you believe to be "the more excellent way."

The officers of the college are gratified at the prospect of receiving a greater number of students from the oral schools than have come to Kendall Green in the past, and while they cannot feel justified in acceeding to the particular demand of your letter, at least until their own experiment has proved a failure, they are ready to give the most earnest assurance that, with every orally-taught pupil who may seek admission here the coming year, no pains will be spared to preserve undiminished whatever powers of speech and speech-reading such pupils may bring with them.

The force at present available for articulation teaching in the college will make it possible for us to give special individual training to such orally-taught pupils as may seem likely to derive more benefit from instruction so afforded, than when given in a class.

Some editorial comments on your letter, which appear in the *Silent World* of yesterday, leave me to say, in closing, that nothing could be further from the truth than an assertion that the present attitude and existing arrangements of the college as to oral teaching put the stigma of governmental condemnation upon the oral method. The fact that ten instructors are devoted to the work of speech teaching in the college is a sufficient refutation of any such claim. It by no means follows because a certain manner of using a certain method is found helpful to certain deaf children in primary schools, that the identical way of making use of this method is necessary, or will even lead to the best results, with these same persons under the changed conditions of collegiate instruction. And it would be a most distorted inference to conclude that because the college gives oral teaching to its students in a manner somewhat different from that employed in the pure oral schools it is thereby placing a stigma on the oral method.

The editor of the *Silent World* is quite right in acquitting "the authorities at Washington" of any such intention, and I trust the statements of this letter will give wings to all his apprehensions on the subject.

Our directors feel that the existing arrangements of the college, under which the essential features of the two leading methods of instruction are combined in a manner calculated, as they believe, to produce the best results, ought to satisfy the friends of both methods.

They have great confidence that results in the near future will prove the wisdom of these plans. And whether this confidence be misplaced or not, they think they have a right to expect that no unfriendly attitude will be taken towards the college while the important experiments only recently begun are being pressed steadily to a decisive conclusion.

Very sincerely yours,

E. M. GALLAUDET.

THE TEACHING OF SCIENCE.[1]

THE subject chosen for this paper, The Teaching of Science, is a broad one; far too broad for more than a very superficial treatment in the time allowed, but it is my purpose rather to call attention to certain general ideas in which too much of our modern science teaching seems to be at fault, and to try to suggest lines in which we may hope for improvement, While I use the term "Science," I have particular reference to the so-called natural sciences, though perhaps the ideas are capable of a wider application.

Among these natural sciences there are certain ones to which my attention has been more closely drawn, but I believe the principles which should be at the basis of instruction in them will apply equally well to all.

Why do we study the sciences? how far do we attain our ends in this study? and is it possible for us to attain them more completely than by our present methods? These are the three questions I desire to consider.

1. Why do we study the sciences? Were we to judge from the great mass of science teaching of the present day, we would be obliged to answer unhesitatingly that the natural sciences are taught chiefly at least, for the purpose of acquiring certain facts which are supposed to be of the necessary stock in trade of a well educated man or woman, or perhaps I should speak more correctly, were I to say, facts which every well educated person ought once to have known sufficiently well to have passed an examination in them ; in as much as, for better, for worse, most have forgotten a great share of these acquired facts. I say were we to judge by the way science is taught, though few teachers would admit this mere acquisition of facts to be their aim in teaching. If we should inquire of these teachers, they would undoubtedly tell us of the "disciplinary value," that vague expression often heard and so unsatisfactory to the pupil, as he repeats his *amo*, *amas*, *amat*, or pauses to rest on his *pons asinorum.*

In all education we have two aims; the direct furnishing of the mind with a store of facts and the development of the mind so that it can utilize these facts and attain others; we teach, and we teach how to learn, Now there are undoubtedly, a vast multitude of facts in the natural sciences, which are of practical value in every-day life; but after all these are of little importance compared with the tremendous development of the mind which may be and ought to be gained by this class of studies.

The natural sciences are pre-eminently the studies to develope the reasoning powers ; every step has been and can be logically worked out from the preceding ; nowhere else do we find that gathering of facts, perhaps very few in number, under an hypothesis, and then, by gaining new facts by study and experimentation, the development of the hypothesis into a theory and, it may be, a law. The best instruction in logic I ever had was in a class of a dozen or so, where we had each made quite a series of apparently unconnected experiments in physics, then were given the task of arranging our descriptions of these experiments in their proper sequence, discussing in the class room our arrangements and defending each his own choice.

The chief aim in the study of science should be this development of the reasoning power ; the teaching of independent thought; and the acquisition of facts in themselves, however important some of them may be, should invariably be made subordinate to this. I ought in this connection to refer to what is often spoken of as a very important aim of science teaching, that of training the power of observation. Of course when rightly studied, science does train this power, and even the most superficial elementary course in any science cannot fail to make the scholar now and then a little more interested in observing what goes on around him than he otherwise would be; nevertheless the training of this power is of value only just as far as it is a means of training the reasoning power. A man may have a marvellous gift of seeing everything and seeing it accurately; but this gift is of value to him only as far as he can utilize it as a basis of thought; and therefore I would hold that the training of the power of observation is embraced under the all important aim of science teaching, the development of the mind, the development of the power of thought.

This should be the chief aim of all instruction in natural science ; all else is of little use.

2. Now how far does the instruction given in our institutions of learning, our schools, academies, colleges, and universities, tend to carry out this idea?

Until until quite a recent time there has been little or no instruction in natural science given in our lower schools; in our cities at the present time there is more or less of an attempt being made to introduce the study of chemistry and physics. I leave out of account for the present the kindergarten, where there seems to have sprung up a germ of the true idea of science teaching. The most that is expected in our common schools is that the teacher shall hold a few recitations from a text-book, from which the scholar is supposed to familiarize himself with a large or small number of facts and possibly to learn the statement of a few laws or theories. In the higher schools, the academies, and some of the colleges, a somewhat greater task is attempted; here the text-book is supposed to cover practically the whole science and a correspondingly great number of facts is sought to be memorized; with a couple of recitations a week, the student is expected to go through "fourteen weeks in chemistry," or physics, or geology, and to have learned the gist of the whole science. Here we have a mere feat of memory. of just as much value, perhaps, as the committing to memory of so many lines of "Paradise Lost," certainly no more. In many, perhaps most, cases the teacher is as ignorant of the subject as the scholar, and must have the text-book continually open in order to recognize if the answers are correct. One college in Kentucky advertises to give complete, thorough, and practical courses in each of the sciences in a term of ten weeks; think of acquiring chemistry, physics, geology and astronomy in less than a year, and not neglecting other studies in the meantime! Of late, however, it is coming to be very generally recognized that scientific instruction cannot be imparted without experiment, and so the teacher performs before the class some of the simpler experiments. This is indeed a step in the right direction, but in most cases only a very short step. An experiment merely as something for a class to look at or be entertained by is valueless; indeed the only value of an experiment is in making clearer the principle it is intended to illustrate. If it fails to do this, it fails to accomplish any thing. I remember asking a young lady, who had a few months previously passed a fine examination in chemistry in one of our higher institutions, if she remembered how oxygen was made, "Oh yes," she said, "why! the professor took something black and something white, and that was oxygen." Some features at least of the experiment had made an impression. In most of the colleges and academies for ladies, I think it is no exaggeration to say that science study as usually conducted is of no value ; the only science which there is an attempt to study at all thoroughly is botany; and even here it is questionable to my mind if the student get from this any thing which justifies the time put upon it, except that incidentally the fresh air exercise obtained in gathering specimens provides that which is much needed by all young ladies. The end usually sought is ability to analyse, by the aid of tables, the common plants, rather than the study of these plants. In no other science is the absurdity of this method of study so apparent. In the chemical laboratory it is true that the use of analytical tables is a prominent feature, but there seems to be at least a practical end attained. Imagine a study of zoology or of mineralogy which should find its end, not in studying the animal or the mineral, but in merely finding out by a set of artificial tables what it is, and we see the fallacy in calling it science. I believe it would be better for all students of botany, and I think

[1] Read before the Kentucky College Association at its latest meeting.

I may add, of chemistry as well, were all analytical tables destroyed.

This brings us to the subject of laboratory work, the *sine qua non* of scientific study. This is at the present day, so far acknowledged that in none of our colleges, and few of our better high schools and academies, would the instructors think for an instant of trying to teach certain sciences without the laboratory. We may thank the chemist for the introduction of the laboratory idea. But to-day there are few colleges, except the larger, and still fewer of our academies, where we find physical or biological laboratories; yet, even with the laboratory, we have by no means reached the ideal in scientific instruction, save in a few institutions. Take, for example, much of the laboratory instruction in chemistry. With a book of directions before him, the student performs certain experiments; with a set of tables, he goes through the process of perhaps separating the metals, and may become even a good analyst, without having profitted to any considerable extent by his work, all being performed mechanically, In the physical and biological laboratories there is far less danger of this misapplication of scientific study, and this largely from the fact that laboratory work in these sciences is a more recent idea and less systematized. In our modern education there is a most pernicious tendency, well exemplified in botany and chemistry, as we have seen, but found in other studies than the sciences, toward machine instruction. Everything is most systematically arranged, and students, bright and dull, are all dosed with so much per diem. The text-book is made everything, and the teacher nothing; and, as a result, we are losing our teachers. Their function seems to be no longer to teach, but merely to see that the required dose is taken. The scholar loses his individuality, and merely becomes like the Strassburg goose, cooped up and so much food forced down its throat so many times a day, the only demand being that on examination day its liver shall have attained the regulation size. In our larger colleges, where each instructor is confined to but one branch, and is, as a rule, an expert in teaching that branch, things are more as they should be; the true aim of science study is more nearly attained. But here these instructors are met with the difficulty that the student has so long been the victim of bad methods that it is almost impossible to successfully introduce the good ones. Then we must further even bear in mind that the great mass of the youth of our land do not have the advantage of college. It is but a small percentage who even enter the high school. Has science nothing to do for those whose school-years are few in number and who are to make the great bulk of our citizens? I believe she has, and will try to point out, or at least to hint at, what seem to me to be the methods by which science-teaching can be made to accomplish its true mission.

3. That which we must seek to do may be expressed very simply. We must seek to so teach science that the student, be he man or woman, boy or girl, or even a little child, shall be led to think about phenomena. If the great good to be attained by science study is the development of the power of thought, we must do all in our power to induce thought. The kindergarten, child's play, as too many consider it, may teach us an important lesson. It is play indeed, but the child is led to think about his play, and the effect of kindergarten instruction may be clearly seen in those who have had the advantage of its training. It is surprising how few even of our college students are capable of independent thought. We see the lack of this thought in the sets of answers to examination questions now and then published, generally with the idea there is something humorous about them. They may for the moment excite our laughter, but rather are they a cause for pain, as bitter examples of the deficiency of our system of education. I would have science-teaching begin with the first of a child's education, or rather it should begin at home, long before the child is thought old enough to study the alphabet. If the child is taught to notice anything in nature, be it a stone or an insect or a little rill of water, he will need but little encouragement to ask questions about it, and, by a judicious directing, he can be led to do his own answering. I have seen a little girl, hardly six years old and unable to read, reason out for herself the general principles at the basis of evolution by merely calling her attention to a few little clumps of blue and white and yellow violets, growing in close proximity. In the lowest grades of our schools the teacher should encourage children to collect all kinds of natural objects, and those found in any locality will be amply sufficient for science study. One of the "plays" in the kindergarten is for the children to plant different kinds of seeds and watch their growth. Similarities and dissimilarities attract attention. We all know the innate desire in every child to dig up the recently-planted seed and see how it grows. The kindergartner wisely utilizes this.

In the few years of common school, the child will have perhaps not the least systematic scientific knowledge, but he will have learned to think about all that goes on around him, and then when, at a later period, he takes up the sciences systematically, he will find that he is already possessed of a great number of facts which will almost arrange themselves, and that not merely in an orderly manner but, what is far more important, intelligently. In our common schools I would have science instruction given from the lowest to the highest grade, and this wholly without the aid of text-books. A short time should be taken every day, with each class, for this purpose, the teacher endeavoring to interest the class and draw them out on some natural object or phenomenon.

It matters little what the particular science chosen may be; if there be one in which the teacher is especially interested, that is the one to use; a handful of marbles, a base ball, or a bat, will serve to interest the boys and instruct them on many a point in mechanics; a few rubber bands stretched across a cigar-box, in sound; a mirror, a burning-glass, and a prism, in light; zoology affords, throughout its whole field, countless specimens for entertaining instruction to the young; they may in familiar examples, and in specimens of their own collection, study the different developments and uses of homologous organs, as the arm of man, leg of mammal, wing of bird, and fin of fish; or the different modifications of the same organ, as the comparison of the eyes of vertebrates with those of insects and molluscs; or the different organs used for the same purpose, as the organs of prehension in man, monkey, elephant, parrot, snake, lobster, and insect; or, on the other hand, they may find it more interesting to study from a systematic standpoint, finding out for themselves the differences between animals of different classes, as between herbivores and carnivores, insect-eaters and rodents, insects and spiders, one-shelled and two-shelled molluscs. It may in some localities be possible to compare some of these modern forms, as snails, with very similar fossil specimens near at hand; and here we can call geology and paleontology to our aid in work with children And again, just to allude to one more science available for this work, the kitchen closet, with the occasional aid of a few cents' worth of some acid or the like at the drug store, will afford us most ample opportunity of impressing the most important lessons of chemistry; combustion, respiration and decay, pure air and ventilation, dryness as a disinfectant, fusion, solution and crystallization, and a thousand similars, many of them of great practical value in their applications, but far more useful as agencies for thought development, come to our mind as possibilities in chemistry as a science for the young. I might take up each science in its turn, for each can easily be made to serve its purpose, but these examples will illustrate what can be done in any one of them; not one thing mentioned but is within the reach of any faithful common school teacher; but how long will it be before we see any general materialization of such ideas?

Thus far I have referred to scientific instruction in the lower schools, which do not so directly concern the members of this association; the same principle, however, is applicable to the higher schools, and we must not forget that the lower schools, which lie at the basis of our civilization, are just what our higher institutions make their teachers. When the high school and academy are reached the possibilities in scientific instruction broaden vastly. In the case of those who have had such elementary training as described, the task is easy; but the problem is harder with others, owing to the difficulty in teaching correct methods of study to those who have for a period of years been drilled in bad ones. Eight or ten years of learning by rote are enough to unfit a child for anything else. Two points we must have before us if the scientific work is to be done for the purpose of attaining its chief end: we must as far as possible lose sight of study for either practical ends, or for the purpose of general information; and we must as far as possible adopt laboratory instruction. In regard to the first point, we suffer more in our academies and high schools, but perhaps also in our smaller colleges to a lesser extent, from rushing through these abbreviated courses in the sciences, than anywhere else; here it is chiefly that we find the task set of giving every student an outline view of every science, embracing as many diverse facts as his memory can hold. Particularly are the fairer sex compelled to suffer in this regard. Better far to take a single science and develop it much in the same way, though more systematically and to a more extended degree, as that already suggested for use in lower schools.

As regards the laboratory work, it may be very simple and inexpensive, but it is an invaluable aid in science teaching; a table, a dissecting case, a lens, a few glass jars, a few chemicals, and if possible a small microscope, slides and cover glasses, will form a sufficient equipment for a very practical biological laboratory; even some of these are not absolutely necessary, as the dissecting case may be replaced by a good knife. For botany the lens, or better the microscope, is almost alone needed; for mechanics, a few of the most familiar carpenters' tools and a bench for work, comprise the necessaries, while in the other branches of physics but little is needed. Even in electricity, a few pieces of copper and zinc, some old electric light carbons, a few chemicals, some wire and a magnet, will go a long way in instruction. Chemistry is supposed to require the largest outfit, and yet I think that some of our dealers in such goods could make no little profit by fitting up collections of chemicals and apparatus for the purposes we are considering, at the cost of not over a dollar for a full set for each student, and five times that amount for the teacher's set; in other words, expensive equipment is wholly unnecessary for elementary laboratory instruction in any of the sciences, indeed in too many cases, an extensive set of apparatus and fittings distracts the attention of the student from the experiment he is studying. Now in using the laboratory, let it be clearly understood that there is no "practical" aim sought, but merely that the student shall think out for himself all the facts connected with the experiment; if it be considered that a knowledge of certain facts is necessary to his education, let him be shown where in the dictionary or encyclopedia these facts may be found.

Our brains are limited in their capacity, and if we load them with that which is of little or no use, there will be little space left for that which is of more importance. Let the student know just where to go for these facts, rather than have his mind filled with them in preparation for examination day. Our aims in science study will be best attained by a few simple experiments, carefully studied and reasoned upon, and these every higher institution ought to furnish.

When we come to science instruction in college, the same train of reasoning applies, but here it is far easier to carry out our principles. It obtains in college, as in the lower institutions, that the student is expected to gain at least a smattering of the chief sciences; still, with our optional studies, the chance for obtaining the true aim of science study is far greater. One reason for this is the increased time allowed to each subject, and the fact that the teacher is more or less of a specialist in the branch or branches he teaches. Let us in this connection look a little more closely at the science with which I, as a teacher, am more familiar than any other, that of chemistry; for this will serve us as a type of them all. Chemistry is studied at college by two classes, one that desires to gain a thorough knowledge of the subject, usually for some practical end, and the other, generally comprising all the students who pass through college, desiring merely to gain a general view of the whole field. Since a thorough study of the chemistry of the non-metals is necessary as a foundation for further prosecution of the science, and since the time required to lay such a foundation is fully as much as the majority of the students can spend on the whole subject, it has been in many places in time past, and indeed perhaps we may say is to-day, the general plan to let the two divisions work in entirely different plans, the one class going superficially over the whole subject of chemistry in a term, while the other proceeds slowly and thoroughly. This is, I believe, a great mistake; the rapidly moving class is at just the same disadvantage as the academy and high school classes we have already noticed; they are trying to learn facts and statements, and thereby lose the true aim of science study. It would be far better for them by slow study to thoroughly master the principles of the science, and gain its value in stimulating thought, and in a few days' reading at a later period they could gain a far better knowledge of the whole subject than otherwise in the whole term. The student should, in the laboratory, perform after the professor each of the simpler experiments, and be questioned particularly and chiefly as to the meaning and signification of the experiment. In the quantitative laboratory he should study the metals comparatively, paying particular attention to similar reactions by which metals may be classed together, and to dissimilar reactions by which the metals may be distinguished and separated. In this way he may cut himself loose from all artificial tables except as far as he shall form these tables for himself as a result of his work (I may here perhaps be allowed, by way of parenthesis, to add that I believe it will be found more advantageous for the student, when beginning work on the metals, to examine first the effect of each of the common reagents upon all the metals, than the commonly adopted method of testing each metal with all the different reagents; in this latter case the student for the time being loses sight of comparative reactions).

The more thorough a student is in his work, the more he applies to it all his power of thought; the better his mind will be fitted to carry the science into practical work, should such be his ulterior aim. The more he works by rule, the less fitted will he be for more advanced work, and the less able to leave the beaten track.

The general principles here laid down in the study of chemistry, will be applicable to the other sciences. It will be better far for the student to cover less ground and to lay a thorough and thoughtful foundation; the further general knowledge of the subject will be easily and quickly gained whenever it may be desired. So too as regards the idea that a student should study at least a little of every science. To my mind it is better far to devote one's self thoroughly to one science or perhaps two in college; so similar are the methods of thought in them all, that he who has mastered one, can take up by himself any of the others sufficiently well to gain as much knowledge of it as a *liberal education* demands, while he who devotes himself in college equally to all will not only know little of any one, but he will almost, if not completely, have failed to gain the development of mind which science study should give him, and the superficial knowledge and facts gained will, for the most part, pass from his mind, as soon as examination day is over. With the scientific method of thought once gained, however, the facts in all other sciences, will naturally fall into such logical sequence that they will, for the most part, readily remain in the memory.

In summing up this paper let me repeat in conclusion that in my opinion, science study, to have its true value, must have ever before it from Common School to College, as its chief aim, the development of the power of thought; without this aim, it is time largely thrown away; with it, it is one of the most potent agencies in modern civilization. JAS. LEWIS HOWE.

Polytechnical Society, Louisville, Ky.

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.*

On request in advance, one hundred copies of the number containing his communication will be furnished free to any correspondent.

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

The Question of the Celts.

I REPLY with much pleasure to Professor Haynes's inquiries in *Science*, April 8, p. 207.

The theory of the European origin of the white race was advanced by Omalius D'Halloy (who is almost as well known for his labors in ethnology as in geology) in various papers published previous to 1850 in the *Bulletins de l'Academie Royale de Belgique.* These must have been known to Dr. Latham, though he nowhere acknowledges indebtedness to them.

The work of Broca, in which he states that the Celts were a mixed type, is his "Nouvelles Recherches sur l'Anthropologie de la France." His words are, "C'est dans cette race mixte que se constitua plus de quinze siecles avant J. C. la nationalité des Celts."

In designating the ancient, blond, dolichocephalic people as Kymric, I follow the best French authorities, such as Dr. Collignon. The ancient Britons, Queen Boadicea and her subjects, were of this type. I cannot understand how Professor Haynes can say "all Celtic people now have black hair," in view of the type of the Scotch Highlanders and the Irish east of the Shannon. In reference to the invaders of Rome, I simply claimed that they spoke a Celtic dialect; I now go further and aver that, in the case of free tribes, speaking a dialect does prove blood relationship in all cases I know of. D. G. BRINTON.

Philadelphia, April 19.

The Question of the Artificial Production of Variations in Type.

ATTEMPTS have been made to modify the forms of animals, or produce new species, by deforming the parent, e.g., in the case of the attempt to produce a breed of short-tailed mice by mutilating the tails of the parents. Is this not beginning at the wrong end? Are not all transmitted variations transmitted by parents which were modified before birth? All successful attempts to produce and transmit modifications in the breed being the result of breeding from animals that have been congenitally modified, would it not seem the proper and only method to study the laws governing the modifications of the embryo and having discovered these, the production of modifications in species would be a matter of slight difficulty. Congenital variations are the result of law and not of chance. GERALD M. WEST.

Clark University, Worcester, Mass., April 17.

AMONG THE PUBLISHERS.

MESSRS. MACMILLAN & CO. have issued a second edition of Mr. A. R. Wallace's well-known "Island Life, or the Phenomena and Causes of Insular Faunas and Floras." The work has been carefully revised throughout, and, owing to the great increase in our knowledge of natural history of some of the islands during the last twelve years, considerable additions and alterations have been required.

— We have received a copy of the "Graphic Atlas and Gazetteer of the World," edited by J. G. Bartholomew, F.R.G.S., F.R.S.E., and published by Thomas Nelson & Sons. It is an entirely new atlas, with over 220 maps, charts, plans of cities, etc., all revised to the present date. A most valuable feature is the Gazetteer of of the World, with nearly 55,000 places, specially complete in American names, and results of new census. In the United States section a separate map is given of each of the States and Territories, specially compiled from the latest Government Survey Maps. In proportion to its contents this volume is quite unique among atlases for compactness and portability. It is of quarto size, bound in half-morocco, gilt top, and sold at the very moderate price of $7.50.

— Both admirers and critics of Spencer will be interested in the paper on "Herbert Spencer and the Synthetic Philosophy," in the May *Popular Science Monthly.* The writer, Mr. William H. Hudson, was formerly private secretary of Mr. Spencer, and gives an insight into the process by which his philosophic thought unfolded. The paper contains also a statement of the relation between the work of Darwin and that of Spencer. Professor Frederick Starr will contribute some "Notes upon Anthropological Work in Europe," telling what museums and other facilities for the study of anthropology exist abroad. The article is illustrated with twelve portraits of leading European anthropologists. "Cave-Dwellings of Men" is the subject of a copiously illustrated article by Mr. W. H. Larrabee. It relates not only to the ancient cave-dwellings of America and the Old World, but describes also the way in which modern troglodytes are living in several parts of Europe to-day. In an article on "Evolution in Folk-Lore," Mr. David Dwight Wells gives two versions of a negro legend nearly a century apart in time, which show the alterations produced in the tale by the change from free life in Africa to slave life in America. An Index to Volumes I. to XL. of *The Popular Science Monthly* is well advanced in preparation, and will be published in the course of the coming summer. The entire contents of the forty volumes will be entered both by author and by subject in one alphabetical list, and the Index will have all the most approved features of the latest magazine indexes, besides some novel ones. The compiler is Mr. Frederik A. Fernald of the editorial staff of the *Monthly.*

— *Nature* notices the appearance of a very useful work, in Russian, by Professor Samokvasoff, on Russian prehistoric antiquities, under the title of "Foundations of a Chronological Classification of Antiquities, and Catalogue." As seen from the title, the work consists of two parts: a catalogue of the very rich collection of the Russian professor, partly illustrated, and a general description of the various epochs which may be distinguished in the relics of the past on the territory of Russia. He has no difficulty in showing that the Slavonians of the first centuries of our era were by no means mere savages. The burial places of that period, usually situated close to the earthern forts, some of which must have required the work of a considerable population, contain hundreds and thousands of graves, so that it is certain that the Slavonians of that period were living in large societies, and had their fortified towns. The same burial customs prevailed over large areas, but the treasures now unearthed from various graves show that differences of wealth and social position existed at that time as well. Considerable amounts of Greek, Roman, and Arabian gold and silver coins were found in the graves, the metal alone of the coins found in some graves attaining, at its present prices, the value of several hundred pounds; while numbers of objects of art, of Greek, Roman, Byzantine, and Arabian origin, are proofs of the brisk foreign trade which took place at that time. The graves of the pagan Slavonians contain flax, woollen, silk, and gold-embroidered tissues; ornaments in gold, silver, bronze, and bone; iron weapons and parts of armament; gold, silver, bronze, iron, and clay vessels, and so on; while the sickles and the grains of wheat, oats, and barley which were found in the graves of South Russia, together with small idols and other objects devoted to pagan worship, are proofs of agriculture having been carried on during the pagan epoch.

INDUSTRIAL NOTES.

Scientific Improvements.

It has been the good fortune of an American firm, J. W. Queen & Co., of Philadelphia, to furnish an epoch-making contrivance for those who have to use the lantern at varying distances from the screen. The NEW MULTIFOCAL ATTACHMENT, which they have wisely protected by patent, is the most valuable accessory that has ever been offered to the exhibitor and lecturer. It consists of *an achromatic* combination of lenses which is placed just behind the ordinary projection objective. This new accessory, having been prepared after a special formula, is so delicately adapted to its work that its curves help to correct and improve the definition of the objective, but the principal purpose of this new accessory, as expressed by its name, *multifocal,* is to provide many points of image production in the range of the objective, each image point giving a different size of picture for the screen, according to the desired distance. In common experience the lecturer is obliged to set the instrument at one invariable distance from the screen, or else carry several screens of different sizes. Every one can appreciate the relief offered by the Multifocal Attachment, which allows complete liberty of choice for the station of the lantern with only one screen. The exhibitor can now literally "cut his coat according to his cloth," and diminish or increase the size of his picture so as neatly to cover the screen at any distance. It is simply impossible to express the satisfaction and freedom from care which the possession of this admirable contrivance gives to one whose problem includes night after night the provision for work in halls of many dimensions. But besides having to carry screens of different sizes, the operator needed heretofore three or four pairs of objectives of different powers, a matter of great expense, besides the cumbersome task of packing and unpacking several sets of glasses.

The multifocal attachment not only dispenses with the burden and expense of additional objectives, but also furnishes a picture more nearly PERFECT than the best combination gives without it, never disturbing the equilibrium of the system of lenses, but adding new powers of definition with entire freedom from distortion of lines and color dispersion.

This attachment can be furnished in three graded powers to suit different objectives.

A varying size of picture on the same screen is sometimes desirable. When a portrait or statue is to be shown, it might be desirable to have it relatively larger or smaller than the scale of the landscape views. To effect this formerly required a change of objectives and an unpleasant interruption; but with the new attachment the statue may be shown life-size or colossal, and a portrait can be reduced to precisely the best size for life-like presentation.

The phantasmagoria effect with the MULTIFOCAL ATTACHMENT is now possible without moving the lantern backward or forward. Simply by increasing the distance of the multifocal system, the picture can be reduced to a disc of light of a few inches diameter, and slowly or rapidly enlarged to cover the whole screen. In scientific demonstrations the operator sometimes needs a sharpened pencil of light or a parallel beam. Such wants are readily met by this wonder-working improvement. All workers with the lantern should know about it, as they will appreciate what can be accomplished with it in covering all perplexities in the distance and size of picture on the screen.

See advertisement in another column.—*Commun'cated.*

CALENDAR.

Biological Society, Washington.

April 16.—C. W. Stiles, Notes on Parasites: Tænia ovilla in its Relation to Blanchard's Classification; F. V. Coville, The Flora of the High Sierras of California, New Plants from California, Nevada, and Utah; Erwin F. Smith, A Review of Baillon's Botanical Dictionary; J. N. Rose, Mexican Leguminosæ with Notes on Dr. Palmer's Collection.

Society of Natural History, Boston.

April 20.—John Murray, Some Recent Investigations into the Physical and Biological Conditions of the Locks and Fjords of the West of Scotland; E. Adams Hartwell, An Elevated Pot-Hole at Fitchburg, Mass.; George H. Barton, Additional Notes on the Drumlins of Massachusetts.

QUERY.

Can any reader of *Science* cite a case of lightning stroke in which the dissipation of a small conductor (one-sixteenth of an inch in diameter, say,) has failed to protect between two horizontal planes passing through its upper and lower ends respectively? Plenty of cases have been found which show that when the conductor is dissipated the building is not injured to the extent explained (for many of these see volumes of Philosophical Transactions at the time when lightning was attracting the attention of the Royal Society), but not an exception is yet known, although this query has been published far and wide among electricians.

First inserted June 19. No response to date.

N. D. C. HODGES,
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SCIENCE

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SCIENCE

NEW YORK, APRIL 29, 1892.

THE NEW METHOD OF PROTECTING BUILDINGS FROM LIGHTNING.

In this week's number we publish a letter on a case of lightning stroke, and would take occasion to suggest that it may help to clear up our ideas on these apparently erratic phenomena if we constantly bear in mind that the energy, just before a lightning flash, according to our present conceptions of electricity, exists in a more or less considerable mass of dielectric (the atmosphere and a portion of the earth), which includes the two points between which there is a difference of potential. In other words, if there is a difference of potential between a cloud and the earth the electrical energy exists diffused for the most part throughout a mass of air extending from the cloud to the earth, some, of course, existing in the surface layers of the earth. Now, when the flash takes place, all will agree that this energy manifests itself as light and heat, and in the knocking of things to pieces, perhaps.

We can but confuse our minds if we continue to think of the energy which causes the damage, or heat, or light, as coming from above or below, but should rather consider it as shrinking in, as it were, from all the circumambient dielectric to the places where it manifests itself as a heated line of air (the flash), or in the broken house-wall. The energy, which is what does the harm, comes, in the case of a vertical discharge not from above or below, but in the main horizontally. Do not let any one misunderstand me as saying that the electricity in such a case moves horizontally, for I do not. As I pointed out in my article in *Science* of April 8, I do not yet know of a case where the destruction, by the discharge, of a small conductor has failed to protect all else between two horizontal planes passing through the upper and lower ends of the dissipated conductor. It may be well to cite a few more cases of such protection resulting from the expenditure of the energy upon a small metallic conductor.

In the Philosophical Transactions, xlix., p. 298, is a paper read Dec. 18, 1755, by G. Brandir, Esq., descriptive of the striking of the Danish church in Wellclose Square, in which it is related that "on Monday, the 17th past, between six and seven o'clock, there was, among many others, one most amazing flash, accompanied with a clap of thunder, that equalled in report the largest cannon! That the next morning, observing the church clock to be silent, they went to the belfry, and found the wire and chain, that communicated from the clock in the belfry to the clapper in the turret, where the bells hang, to be melted; and that the small bar of iron from the clock, that gives motion to the chain and wire, just where the chain was fastened, was melted half through, the bar being about three-fourths of an inch broad, and half an inch thick. Several links of the chain, and of the wire, I have now the honor to shew you, where it will be observed, that the lightning took effect only in the joints. But whether it entered by communication from the wire exposed to the air in the small turret, through the roof of the belfry, or at the windows, there being several panes broke in the south and west corners, I cannot say; although I presume rather the first way, as it is very possible, that the bare report of the thunder might have occasioned the latter.

"The pieces of the wire and chain were scattered over the whole belfry, nor could it be discerned, that the wood-work, or aught else, had suffered."

There is a case cited in all the books on lightning, which is also interesting in this connection. The packet ship "New York" was struck by lightning April 19, 1827, while in the Gulf Stream. She was provided with a lightning rod, if it may be so called, consisting of a pointed iron rod one-half an inch in diameter and four feet long, at her mast-head, from which extended an iron chain, 130 feet long, to the sea. The links are described as one-quarter of an inch in diameter, whatever this may mean. It is evident, however, that the chain was not a heavy one and that, being a chain, it was a conductor of variable resistance, a condition well known to be conducive to destruction in case of the passage of a high-potential current. The rod was struck. A few inches of the terminal were melted, and of the chain all except three feet was dispersed. The important fact here as always, so far as yet known, is that no damage was done to the ship by the lightning.

My method of protecting buildings from lightning consists simply in placing on the building, from its highest to its lowest part, a small conductor of variable resistance, so as to make sure of its destruction in case the house is struck. And I base my confidence in its success on the fact that, exercising all possible diligence in the search through the records of actual cases of lightning stroke, I have not met with a case of failure of such a conductor to protect, when by accident it has been employed; and, further, I have failed to elicit any exceptions by the numerous methods of publication I have employed.

I employ one or two pounds of copper on a house of the ordinary size, and if anyone will take the trouble to calculate, according to the best data at our disposal, the energy dissipated in the evaporation of a pound of copper, he will understand how it is that there is none left to do further damage.

Another point which the records bring out, and which has been noted by others, is that damage occurs near large masses of metal. The small masses of metal, if not in confined spaces, burn as harmlessly as gunpowder on a sheeet of paper.

N. D. C. Hodges.

874 Broadway, New York.

Spaniards are making a good many preparations for the celebration of the four-hundredth anniversary of the discovery of the the New World. In the autumn of the present year, says *Nature*, there will be several exhibitions, in one of which will be shown objects relating to the continent of America before the advent of Europeans, while another will illustrate the state of civilization in the colonizing countries of the Old World at the time when the new continent was discovered. In October the Congress of Americanists will meet at Huelva, and will discuss a variety of subjects relating to the continent of America and its inhabitants 400 years ago. In the same month, at Madrid, a Spanish Portuguese-American Geographical Congress will meet for the discussion of such questions as relate more particularly to the "Iberian-American" races, their aptitude for colonization, and the future of the Spanish language.

COLLECTING GORILLA BRAINS.

AT A recent meeting of the Academy of Natural Sciences of Philadelphia, Dr. Henry C. Chapman described three gorilla brains collected by the Rev. R. H. Nassau, D.D., in 1890, upon the Ogove River, West Africa. The brains have been presented by him, through Dr. Thos. G. Morton, to the academy. Dr. Chapman's observations upon these brains are embodied in a paper now in the course of publication in the Academy's Proceedings. At the close of Dr. Chapman's communication, Dr. Nassau related his experiences when obtaining the brains. The appended extracts are from two letters written by him to Dr. Morton in 1890, in which he tells the story of the two expeditions he made to obtain them. The extracts have been made by the kind permission of these gentlemen. JAS. E. IVES.

TALAGUGA, OGOVE RIVER,
GABOON AND CORSICO MISSION,
WEST AFRICA, MARCH 7, 1890.

I made all plans with great forethought as to details; the season would be cool and dry, when I could hunt with less discomfort; no flooded low grounds; a large proportion of the leaves fall in the dry season, leaving the thickets less dense and giving better chance for spying animals. There are scarcely any gorillas in this Talaguga region; I have known of but two being killed during the eight years I have been here. So I closed my house and went down the seventy miles to Kângwe. There I chose a good crew of eight young men. Four carboys of chloride of zinc had been carefully kept all these years; I took a jugful of it. Not to waste my alcohol (in which was to be immersed the brain as it should finally go to you), I took along several gallons of rum. . . . Proper receptacles were taken for receiving the brains. I took my Winchester and double-barrelled gun (suitable for either shot or bullet), and invited with me one of our French associates, M. Gacon, a Swiss sharpshooter, who had the latest Swiss army breach-loading rifle. For the native hunters I took two of the best (very poor at best) flint-lock muskets from the Trading House, good for two weeks, etc.

From this point I will copy from my diary written at the time.

"Wednesday, July 17, 1889. Rose early and by 9 A.M. were at our destination. M. Gacon, after our noon meal, impatiently went out to hunt with Ogula. They returned having seen signs of gorillas, but not having seen the animals themselves. A council was held in the evening with the villagers as to time, routes and the art of hunting a gorilla. Everybody was sure I should not be in the village four days without succeeding; they told wonderful stories of the numbers and audacity of the gorillas, that not two days passed but that somebody saw them in the gardens. As the garden work is done principally by women, it was they who most frequently saw them, sometimes actually meeting them in the path and being pursued by males. From all their accounts the gorilla is full of the arts and tricks of the monkey tribe, quick to read faces. The women being unarmed and afraid, the animals were more daring to them than to men. But they all said that we white people would have no chance of getting so near, that the animils would detect our strange odor and fear our white faces. They hoped we would kill many, for their gardens were devastated by gorillas, pigs, oxen and elephants. Most of the men said that though they often saw these animals, they were afraid to shoot with their flint-locks that often uncertainly flashed in the pan or whose slug-shots were not immediately fatal; that then they were at the mercy of the wounded beasts. They warned us, if we met with a male gorilla who dared to face us, not to fire till only a few yards distant, and, even then, not to aim at the head, for the animal had the art, being acquainted with guns, and all have informed each other (so the natives believe), of ducking down its head at the click of the trigger. We were to aim at the abdomen, which from its size could not fail to be injured, and the head or chest would probably be pierced by the animal's having ducked its head down to dodge a shot aimed, as it supposed, at its head.

"Thursday, July 18. We all went, some fourteen men and eight dogs, in the boat to a large island shortly after sunrise. My own crew of six were afraid and I left them in the boat, and Ogula described the lie of the land so that they were to follow around to another part where we should probably emerge. The rest of us entered the thicket, very dense; it grows up so wherever there are abandoned plantations. The original forest is easily threaded, for the dense foliage of the tall trees kills out by its shade the underbrush. But the gorillas are looked for mostly in the plantations, old and new. But after four hours of search nothing was heard or even seen except the tracks of the wild pigs. In the afternoon Okendo, whose plantation was on another part of the island we had been at, came in frantic haste saying a gorilla was just seen by his wife. We went. Sure enough, there were the pieces of sugar-cane the beast had chewed and spat from his mouth, still wet with spittle, and the broken branches of cassava marked his exit from the garden. We divided into three companies, to the right and left and centre. I was in the centre with Osamwamani. M. Gacon went with Ogula to the right. Ogula was the only one who saw the gorilla, a female; but it disappeared before he could draw on it. This stimulated our plans that night for the next day's work.

"Friday, July 19. M. Gacon started in a canoe with three men at 5 A.M., and I followed an hour later in the boat with my crew and four men, the crew as usual awaiting us in the boat. We went in the general region of the previous afternoon; there were frequent and fresh signs, dung still warm. The thicket was impossible to be passed by a human being in any other than the too noisy way of cutting with the long knives we carried, or by crawling on our bellies under the mass. The mass of vines, bushes and, worst of all, a grass growing many yards in length whose long, narrow leaves were, on their edges, as sharp as knives. The density of this growth above killed out the leaves lower down, and the thicket was tunnelled with many passages, intersecting and opening out into spaces of a square rod or two where might be a clump of trees, and where the animals had their sleeping places on the lower branches. You perceive that even if a gorilla was heard or sighted in such a thicket while we were crawling on our bellies, it could get away before we could snatch our gun into position, and, if the animal should only be wounded, we should be in a very ugly place for defending ourselves. The trail became so hot we were sure the animal was near. We divided, M. Gacon going with Ogula to one side and I and Osamwamani to the other. Suddenly we heard the dog Hector barking sharply, and shortly after the screams of a baby gorilla. The noises did not seem to be more than forty or fifty feet from us; we could *see* nothing. The barking became more savage, the screams more agonized, and, as we tore our way through the thicket, there was added the angry howl of a parent gorilla. Everybody took his own way, losing sight of each other, following the sounds, along our several radii, to the fierce centre. But the bark ceased with a yelp; the screams and howl rapidly receded, faster than we could follow. I emerged into a small open glade, where stood Ogula, M. Gacon and Hector. The dog had come upon a mother and child at the foot of a tree in a hollow, which was still warm. The mother had fled at first sight, but had returned at the screams of the child, which the dog had seized. It was just at this moment that M. Gacon and Ogula saw them. The mother slapped the dog with her hand and the dog dropped the child with a yelp of pain. Ogula allowed the precious moment to pass, fearing to kill the dog with the slugs of his musket. M. Gacon was in his rear and emerged on the scene just as the mother, who had picked up her child, disappeared. He had not a moment's time to get his rifle into position. On our way back to the boat we came to a large glade, where evidently there must have slept that very night not less than twenty gorillas. It was exasperating that we had been only a few hundred yards from that spot the afternoon before and that very morning. All our hands and faces were cut and bleeding by the fearful grass in that frantic rush, and I had hurt my knee by a fall over a log. So we rested and mended ourselves during the afternoon in the village.

"Saturday, July 20. We all rose at three A.M., and, volunteers and all, went to a new place, where on the previous day a large male gorilla had been reported. I did not like the plan, I wanted to go to yesterday morning's region; but Ogula was overpersuaded by the volunteers. Their plan was to form a line across the long point on which the animal had been heard on the previous afternoon. We entered the forest in the dark of the morning. I am not accustomed to such exhausting work before breakfast, and when, after a fruitless search, we emerged again. I was provoked to find that three old volunteers had changed their minds, had not followed us, and were resting comfortably on the sandy beach munching peanuts.

"Monday, July 22. M. Gacon went out with the hunters to a new place, where a gorilla had been heard on Sabbath, but they returned fruitless; M. Gacon had shot a flying squirrel. He went out again in the afternoon alone, but saw nothing.

"Tuesday, July 23. Ogula and Osamwamani, ashamed over our ill-success, declared I should have a gorilla that very day, and went without us before daylight to a distant place. They returned in the evening having seen many gorillas, some of which had taken refuge in high tree-tops beyond the range of their muskets. They regretted not having taken us along. We gave up the search for a gorilla. My knee was still inflamed and M. Gacon's enthusiasm waned. We could not deny that there were gorillas in abundance, but the difficulties in obtaining them were just as obvious"

During all these years from 1882 to 1889, while I was prevented from hunting myself, I had employed a hunter, Azâze, living at Orânga, about 35 or 40 miles down the river from Kângwe, promising him a good reward if he brought me a dead gorilla in good condition. To get it to me in good condition at Kângwe he would have to start immediately and pull day and night. He brought two carcasses here while I was away at Talaguga some years ago, and they were lost, there being no one here to open a skull carefully. He sent a third, a small one, just a year ago. It reached me here just as I was starting up to Talaguga. I had actually stepped into the boat and in five minutes should have started. The messenger had arrived during the night, but had taken his leisure to deliver it. I would have stopped the journey, but the carcass was then spoiled, and what I would have given a large sum for twenty-four hours earlier I threw into the river as worth nothing. His last effort was eight months ago, the week before I went on the hunt to the lake. It was a very large old male. Azâze had made a desperate effort to reach here with it safe. He arrived on a Sabbath noon. I did not go to the water-side to see it, my principles would not allow me to work on it on the Sabbath; but early Monday A.M. I got the brain out, but it was then too soft.

Kangwe Mission Station, Ogove River,
West Africa, October, 2, 1890.

This year in July I went again to another part of the same lake, Kângwe, and hired two native Bakele hunters. They saw in two days' hunting both elephants and gorillas, but failed to kill any. But some Galwa young men, knowing my errand, went out on their own account and found five gorillas, an old male, three females, and a stout grown lad. The place was in sight and gun-sound of the village where I was waiting across one of the beautiful bays of the lake. The females fled; the old male showed some fight, but fled when the lad was shot. The carcass was brought to me still warm. I had a carpenter's back-saw and a chisel, I worked with care; but in my anxiety at the last I gave an unfortunate blow or two and wounded the brain, and much of it exuded under the astringing influence of the chloride of zinc; also, I had no alcohol and had to use trade rum, and I fear that the brain has not been kept by it from decay. A few days later, I by a very, very rare chance bought two gorilla male children; they were in good condition and tamed. The servant in whose care I left them at this place, Kângwe, during a few days' absence neglected them and they were attacked by "driver" ants the night of the day before my return. One survived twelve and the other forty-eight hours. Their cries for help had been disregarded, and when I discovered them they could only moan. I combed thousands of ants off of them. That servant of mine had also neglected to feed them, and they were partly starved before the ants attacked them. The second of these I finally killed, seeing it was dying; and, working very carefully with the chisel, using no mallet, loosened the brain without injuring the membranes. I was afraid to work down toward the base of the brain, so I left it adhering and sawed away the face so as to make the mass small enough to enter the jar. I enveloped it and also the first brain in separate muslin bags so that they should not abrade each other.

That attack by driver ants was made at this house, Kângwe; and one of the little fellows, the one that I finally killed, was still living next day when I started up river by my boat to my Talaguga home, 70 miles, a four days' journey. It died at night at my first camp on a sand-bar in the river, and I did the work at midnight by torch-light. I put the brain in the chloride, and on arrival at my house three days later, put it into rum. R. H. Nassau.

NOTES AND NEWS.

In connection with the celebration of the fourth centenary of the discovery of America by Columbus, the Italian Botanical Society, says *Nature*, invites the attendance of botanists of all countries at a Botanical International Congress, to be held at Genoa, from the 4th to the 11th of September. In addition to the meeting for scientific purposes, there will be excursions on the shores of the Mediterranean and in the Maritime Alps; and during the same time will also take place the inauguration of the new Botanical Institute built and presented to the University of Genoa by the munificence of Mr. Thomas Hanbury, of La Mortola, and the opening of an Exhibition of Horticulture. All communications should be addressed to Professor Penzig of the University of Genoa.

—In the Annual Report for 1892 of the Berlin branch of the German Meteorological Society, Professor G. Hellmann gives an account of his continued experiments, which are summarized in *Nature*, on the effects of exposure on rainfall records, and on the determination of the distance apart that rain-gauges should be erected in order to obtain an accurate account of the rainfall of any district. Simple as the question appears, the experiments, which have been carried on for seven years, have not sufficed to give a definite answer. Very considerable differences are found in the amounts recorded at stations comparatively close to each other. This result is partly owing to the effect of wind, especially in the case of snow. The following are the most important conclusions derived from the experiments: (1) The more a rain-gauge is exposed to the wind, under otherwise similar circumstances, the less rainfall it records, and the higher a gauge is placed above the ground, the less rain it catches, as the disturbing influence of the wind is greater than on the surface of the ground. But if protected from the wind, a gauge will give useful results in an elevated position. The usual instructions to erect the gauge as openly as possible are therefore incorrect. (2) Even in a flat country, differences of 5 per cent occur in different months, at stations a quarter of a mile apart; in stormy weather, especially during thunderstorms, the difference may amount to 100 per cent. The amounts recorded at neighboring stations agree better together in spring and autumn, and also in relatively wet years. Further experiments are needed, if possible by means of anemometers erected at the same level as the rain-gauges, to determine more accurately the effect of wind on both rainfall and snow.

— At a meeting of the Engineers' Club of Philadelphia, April 2, Mr. W. S. Auchincloss read a paper on Yearly Tides. In this paper the author stated that he proposed to show that confined bodies of fresh water are subject to yearly tides of greater or less magnitude, depending upon the nature of the basin or upon the strata to which they are confined, and upon the effect of evaporation if in an open basin. In March, 1885, he had occasion to sink a well near Bryn Mawr, Pa. Natural anxiety as to the permanence of the supply led him to observe the depth of the water at intervals of about ten days. It soon became evident that the water was receding. In 1886 there was a gratifying rise of the surface and a total gain of 12 feet. His curiosity was aroused and he determined to study the law, if such a law existed, of this ebb and flow. These observations have been continued during the past seven years. He found that in normal years the surface of the water reaches its lowest level in December, rises until June, and descends during the autumn. An examination of the amount of the rainfall shows that while the amount of rainfall was as great or greater during the last half of the year as during the first, the level of the water in the well continually lowered. Atmospheric temperature had practically no effect, as the temperature of the water in the well is practically constant all the year round. The depth of the well prevented evaporation from its surface from having any effect. The author believes that the true cause is the result of the influences of gravity and of the sun's attraction at different seasons of the year. When the sun reaches its furthest point south of the equator, gravity exerts its maximum influence on the waters of the northern hemisphere. The waters of the earth will be drawn into the minutest crevices and the surfaces lowered, but in June they will, in a measure, be released, and, under the influence of adhesion and friction, will be held at a higher level than during any other season of the year. Data obtained from the Government records, showing the depth of water in the Great Lakes, show that there is a similar rise and fall, the range of yearly ebb and flow being from 12 to 15 inches in our northern lakes. So far as we are aware, no data exist for the small lakes. More extended research will, we believe, secure as complete a recognition of yearly tides as physical geography has always accorded to the phenomenon of daily tides. The author presented two diagrams, one of which showed the rise and fall of the water in the well covering a period of seven years, and also the northing and southing of the sun for the same period.

— In February, 1890, a grant was made by the Royal Society for the purpose of supplying the Ben Nevis Observatory with apparatus for counting the number of dust-particles in the air. Two instruments, one portable and another of larger dimensions, were made after designs by Mr. Aitken. With the latter observations may be made at any time, except when the wind, blowing from the south-west, pollutes the air above the inlet pipes with smoke from the observatory and hotel. Since February, 1891, observations have been made every third hour. Some of the results are given, and their bearing discussed, by Mr. Angus Rankin in the *Journal of the Scottish Meteor. Soc.*, Third Series, No. viii. It may be stated that a number of particles under 100 in a cubic centimeter of air is phenomenally small, and a number over 4,000 phenomenally large. The highest number was 14,400, which was counted in April, 1891. The particles are most numerous during March, April and May, when easterly and south-easterly winds are prevalent both at sea-level and on the summit of the mountain. On the other hand, when the winds on Ben Nevis blow from the north-west, north, or east, their directions diverge most from those of sea-level winds, and then the dust-particles are most scarce. Hourly observations were made only on four days, but the three-hourly means show the general trend of the daily curve. The means for the three months, March to May, show a minimum, 526, at 4 hours, and a maximum, 1,438, at 16 hours, the absolute mean for the three months being 854. The variations seem to be due to the movements of the first, or lowest, cloud stratum. In the morning this stratum lies below the summit of Ben Nevis, but towards noon rises and envelopes the top, hovers above it in the afternoon, and sinks to its original position about midnight. Several points remain to be cleared up. Apparently only the free dust-particles are counted, and few, if any, of those on which moisture has condensed to form visible fog; all the lowest values have been recorded when a thin mist enveloped the top. These observations will be of great service in the study of clouds—their forms, heights, and motions. The bearing of dust on the humidity of the air is also an important point; at present the humidity of the Ben Nevis atmosphere is very little understood.

— The papers entered to be read at the April meeting of the National Academy of Sciences were as follows: An American Maar, by G. K. Gilbert; The Form and Efficiency of the Iced Bar Base Apparatus of the United States Coast and Geodetic Survey, by R. S. Woodward (introduced by T. C. Mendenhall); On Atmospheric Radiation of Heat in Meteorology, by C. Abbe; On the Deflecting Forces that Produce the Diurnal Variation of the Normal Terrestrial Magnetic Field, by F. H. Bigelow (introduced by C. Abbe); Abstract of Results from the United States Coast and Geodetic Survey Magnetic Observatory at Los Angeles, Cal., 1882–1889, Part III., Differential Measures of the Horizontal Component of the Magnetic Force, by C. A. Schott; On the Anatomy and Systematic Position of the Mecoptera, by A. S. Packard; On the Laws of the Variation of Latitude, by S. C. Chandler; On the Causes of Variations of Period in the Variable Stars, by S. C. Chandler; On the Force of Gravity at Washington, by T. C. Mendenhall; On the Recent Variations of Latitude at Washington, by T. C. Mendenhall; On the Acoustic Properties of Aluminum, with Experimental Illustrations, by A. M. Mayer; Disruption of the Silver Haloid Molecule by Mechanical Force, by M. Carey Lea (introduced by G. F. Barker); On the Homologies of the Cranial Arches of the Reptilia, by E. D. Cope; On the Osteology of the Genus Anniella, by E. D. Cope; The Astronomical, Geodetic, and Electric Consequences of Tidal Strains within an Elastic Terrestrial Spheroid, by C. Abbe; Asiatic Influences in Europe, by E. S. Morse; Exhibition of Chladni's Acoustic Figures Transferred to Paper without Distortion, by A. M. Mayer; On Electrical Discharges Through Poor Vacua, and on Coronoidal Discharges, by M. I. Pupin (introduced by T. C. Mendenhall); Biographical Memoir of William

Ferrel, by C. Abbe; A Definition of Institutions, by J. W. Powell; Biographical Memoir of J. Homer Lane, by C. Abbe; The Partition of the North American Realm, by Theodore Gill; Exhibition of Teeth of a Gigantic Bear, Probably an Extinct Species, Found in Ancient Mounds in Ohio, by F. W. Putnam; A Means of Measuring the Difference Between the Tidal Change in the Direction of the Plumb Line and the Tidal Deflection of the Earth's Crust, A Posthumous Paper by J. Homer Lane, read by C. Abbe.

— Mr. Timothy Hopkins has made provision for the endowment and maintenance of the seaside laboratory at Pacific Grove, recently established under the auspices of the Leland Stanford Junior University. It is intended to make this a place for original investigation of the habits, life-history, structure and development of marine animals and plants and to carry on work here similar to that which is done at the acquarium at Naples. The Hopkins Laboratory will be under the general direction of Professors Gilbert, Jenkins, and Campbell. It will be open during the summer vacation, and its facilities will be at the disposal of persons wishing to carry on original investigations in biology, as well as of students and teachers interested in that line of subjects. It will be fully provided with aquaria, while microscopes, microtomes and other instruments necessary for investigations will be taken from the laboratories of the University.

— At a meeting of the Epidemiological Society (*Lancet*, Feb. 29, 1892) Dr. Pringle quoted a remarkable passage from an ancient Hindu work, which showed that true vaccination was known and practised in India centuries before the birth of Jenner: "The small-pox produced *from the udder of the cow* will be of the same mild nature as the original disease. . . . The pock should be of a good color, filled with a *clear* liquid, and surrounded by a circle of red. . . . There will be only slight fever of one, two, or three days, but no fear need be entertained of small-pox so long as life endures." Pasteur's attenuation of virus by successive cultures has been applied in India for hundreds of years to inoculations with variolous lymph. which the document in question directed to be taken from "the most favorable cases," and he has seen series of such selected inoculations in which there was no general eruption, and the local phenomena were scarcely distinguishable from those of vaccination.

— In a paper, in the April number of the *Botanical Gazette*, on "Some Fungi Common to Wild and Cultivated Plants," Byron D. Halsted, Rutgers College, New Brunswick, N.J., says: "It has been shown by means of a long series of examples that the evil influences of wild plants may act at long range. It is not necessary that their roots and those of the cultivated plants should cross each other's paths in the soil or that their branches should interlock and overshadow one another in a deadly embrace. There is a more subtle bad influence than gross thieving or clutching by the throat. It is more in the nature of a poison that is sent out upon the air to be breathed in by the innocent wherever they may unwittingly meet the unseen but deadly germs. Crowding of plants is bad, rank growth of weeds is worse, but the most fatal of all influences is that unseen group that steal away the health of the plants which lack nothing for room and enjoy high and thorough culture. After all it is the host of enemies that swarm from the plants outside the garden fence that try the patience of the husbandman. He has learned the methods of remedying the others, but the floating spores defy his keenest eyesight to discern and baffle his ingenuity to combat. The ways of the fungi are, however, being slowly and laboriously revealed by the microscope and conquered by the spraying pump. The former assists the latter, which as yet blindly fires effective "small shot" into the enemies' ranks. Proper seeding, fertilizing, and weeding will do much to assist in warding off the deleterious influences of fungous enemies; for healthy plants, while not proof against their attacks, are less liable to be overcome by them. Let therefore everything be done that is possible before the last resort comes and then the fungicide will have the greatest effect and yield the most returns. If so much of the smut, rust, mildew, mold, rot. and blight of our cultivated plants is propagated by the wild plants hard by, it may be wise for every crop-grower to pay attention to what is thriving outside his garden wall. He cannot build it high enough to shut out the spores, but he can do much to diminish the number of these spores. Having done this, he can take up the spraying pump with a brighter hope of future success. There was a carcass, so to speak, in the pasture and he went out and buried it. Fungi are the basis of contagion and they infect at long range by means of their myriads of invisible spores. To learn of their ways and find better methods of resisting them make the burden of many a station botanist's labor to-day."

— At the Washington meeting, Thursday, April 21, of the National Academy of Sciences Dr. Karl Barus, Professor Samuel F. Emmons and Mr. M. Carey Lea were elected members of the academy. Dr. Barus is connected with the United States geological survey, and is well known as a physicist. Professor Emmons is also connected with the geological survey and is a geologist. Mr. Lea is a Philadelphian, and is famous as a photographic chemist. The academy elected four foreign associate members. They were Professor Hugo Gylden of Upsala, Sweden; Professor Carl Weierstross of Berlin, Germany; Professor August Kekule of Bonn, Germany; and Professor E. Du Bois Reymond of Berlin, Germany.

— "On the Track of Columbus," a paper by Horatio J. Perry, is one of the features of the May *New England Magazine*.

— Professor N. S. Shaler, whose articles in *Scribner's*, on "The Surface of the Earth" and "Nature and Man in America," have done so much to make clear the practical features of geology and geography, begins in the May number of that periodical a group of four articles on Sea and Land, in which he will discuss Sea-Beaches, The Depths of the Sea, and Icebergs.

—Some time ago *Public Opinion*, the eclectic journal of Washington and New York, offered $300 in cash prizes for the best three essays on the question "What, if any, changes in existing plans are necessary to secure an equitable distribution of the burden of taxation for the support of the National, State, and Municipal Governments?" The competition has attracted much interest, and the committee, consisting of Hon. Josiah P. Quincy of Boston, Hon. Jno. A. Price, Chairman National Board of Trade, and Mr. W. H. Page, Editor of *The Forum*, have just awarded the first prize to Mr. Walter E. Weyl of Philadelphia; the second to Mr. Robert Luce, editor of *The Writer*, Boston; and the third to Mr. Bolton Hall of New York. The successful essays will be published in *Public Opinion* of April 23.

— "French Schools through American Eyes" is a report to the New York State Department of Public Instruction by J. Russell Parsons, Jr., the same gentleman who not long ago made a similar report on the German schools. Mr. Parsons remarks in his preface that "the belief that everything American is perfect constitutes a false form of patriotism which seems to be growing in this country;" but he maintains that in educational matters we have much to learn from foreigners. France, he thinks, has during the past twenty years made great advances in primary education, and now has some of the best public schools in the world. These schools he describes at considerable length, treating of their legal status and obligations, their organization, the method of selecting teachers, the methods of inspection, the courses of study, and many other aspects of the complex subject. His liberal use of statistics and the dryness of style characteristic of government publications make his book rather dull reading except to those especially interested in its theme; but to such persons it will convey much useful information. The most interesting part of it to the general reader is that which describes the courses of study in the various schools. The object sought by the French authorities is to teach those subjects that every person ought to know and to teach them in the most thorough manner possible. Moral education, too, receives special attention, and is so conducted as not to interfere in any way with the religious beliefs of either the children or their parents. Mr. Parsons gives tables showing the courses of instruction in several of the schools, which, however, we have not space to summarize. The book is published by C. W. Bardeen of Syracuse, N.Y.

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Attention is called to the "Wants" column. It is invaluable to those who use it in soliciting information or seeking new positions. The name and address of applicants should be given in full, so that answers will go direct to them. The "Exchange" column is likewise open.

THE DETECTION OF ARTIFICIAL (IMITATION) GEMS.

IN most works on gems much stress is laid upon "hardness" as a means of distinguishing real from artificial "stones." Having had occasion during the past two years to examine several emeralds, rubies, etc., as to their genuineness, I have come to the conclusion that this property — which is, as everyone knows, of great assistance in the determination of uncut minerals — is of very little value in the examination of cut and polished gems, inasmuch as cutting a stone renders its surface much softer — in some cases reducing the hardness by over one-tenth — so that it can be "scratched" by minerals considerably lower in the scale of hardness than itself in its natural condition. On the other hand, many artificial gems will scratch ordinary window-glass quite readily, and have a hardness nearly equal to that of quartz, although it is popularly believed that if a "diamond" scratch glass it must be real.

Polishing the surface of a stone also necessarily affects its specific gravity, especially if the specimen be of small size, as is the case with most gems. Specific gravity as a means of detecting false gems is also rendered practically valueless by reason of the fact that special care is often taken in the manufacture of these articles to make them have specific gravities as nearly like the natural species which they are intended to imitate as possible.

Gems being usually much facetted, an examination of their optical properties becomes difficult and is of very little use in their practical determination.

Many gems are thought by their owners to be genuine on account of their having been in the possession of themselves or families as heirlooms for many years. Age in this case is no criterion as to value, as it is well known that the ancient Egyptians and Greeks were well versed in the manufacture of artificial stones.

The grand and really only reliable test, it seems to me, as to the genuineness or otherwise of a gem — in case we do not wish to totally destroy the specimen — is an examination of its fusibility. Artificial diamonds, emeralds, etc., if held in the border of the flame of a spirit-lamp or Bunsen burner soon become rounded on their edges, their fusibilities being generally considerably under three, according to von Kobell's scale of the fusibilities of minerals. The real stones, diamonds, etc., with the exception of the garnet, are practically infusible.

Great care should be taken in the examination of the fusibility of a gem, as, if the latter be genuine, it may, unless heated gradually and carefully, crack and fly to pieces on exposure to a high temperature. Moreover, some gems will change color if heated too highly. W. G. MILLER.

University of Toronto.

THE SYSTEMATIC POSITION OF THE DIPTERA.

HAVING been a student of the Diptera for two years, I have come to the conclusion that the order is entitled to the distinction of being, as a whole, more highly specialized than any other. Entomologists who have attempted a general classification of insects have almost uniformly regarded the Hymenoptera as the highest order, placing the Lepidoptera second, and the Diptera third. The only exception in America, I believe, is Professor Hyatt, who, in a recent book ("Insecta," by Alpheus Hyatt and J. N. Arms), has placed the Diptera at the head of the class, with the Hymenoptera second, and the Lepidoptera third. His argument for this arrangement is brief and forcible. The main features may be summarized as follows: —

The essential question which settles the rank of any insect is, How far does it deviate in structure, and through what line of descent has it developed, from its Thysanuriform ancestors? To introduce the subject of instinct or of usefulness to man is to confuse our ideas, for we cannot translate the data furnished by such a criterion into terms of the other standard. Applying this principle, he takes the following features of Diptera to show that they possess a degree of specialization surpassing any other order: —

1. Larval structure: "The young of even the generalized forms of Diptera are, as a whole, farther removed from the Thysanuriform type than those of any other group. The secondary larval form, which in the case of the Diptera is always footless and often an almost headless maggot, has complete possession of the younger stages. As Friedrich Brauer has pointed out, the general absence in the larvæ of Diptera of the thoracic legs, even although living in situations that seem to demand their development, shows that they must have inherited this peculiarity from an ancestral form whose larva had lost them. This comparative inflexibility of the larval stage is sufficient of itself to show that there is now a wide gap between the existing Diptera and all other orders of insects, and that this chasm is not closed by the resemblances of the parts in the adult to those of the Lepidoptera or isolated forms in other orders" (pp. 273, 274).

2. The presence of but two wings: "The tendency to the enlargement of one pair of wings, like the tendency to the enlargement of certain pairs of thoracic legs and the reduction of other pairs, or a change in their structure and function, so that the insect makes a departure from the conventional normal type of four equal membranous wings and six equal-jointed legs, is everywhere an index of specialization" (p. 274).

3. The mouth parts are developed for sucking only.

4. The attachment of the abdomen to the thorax in some flies shows that they once possessed a pedunculated abdomen, similar to that of Hymenoptera (p. 251).

Of these features, the first is the most weighty. Had not its importance been overlooked, the order could never have been thought inferior to the Lepidoptera, of which the members have while larvæ thoracic legs and usually abdominal ones also. Among the Hymenoptera, the Tenthredinidæ have thoracic legs and even more numerous abdominal ones than the Lepidoptera. The Uroceridæ also have rudimentary thoracic legs, although the larvæ are borers in wood.

The second and third arguments are essentially one in principle. In the lower winged insects, we find both pairs of wings of equal size and importance. The Hymenoptera show a condition in which the hind wings are much smaller and so of less use. Now, why do not the Diptera represent the extreme of this series? The question is not whether two pairs of wings or one pair are in themselves "higher;" it is rather, Which type shows the greater departure from the forms universally acknowledged as ancestral? So regarding the mouth development: If the mandibular mouth of Thysanura, Odonata, etc., be admitted as representing the ancestral form, then surely the mouth combining mandibular and suctorial apparatus is intermediate, and that with only suctorial organs is the ultimate degree of specialization. The recent researches of Dr. John B. Smith (Trans. Am. Ent. Soc., XVII.) show that true mandibles are almost never present in Diptera (he found them only in Simulium). Although his conclusions in this respect, as well as in regard to the homologies of the dipterous mouth in general, are widely different from those of earlier investigators, they are probably correct. In summing up, he says (p. 339), "The development required is simply a further development of the line started in the Hymenoptera."

An argument that strongly reinforces the first one above is found in the fact that the embryo in Diptera, at least in the higher forms, does not develop any traces of legs, differing in this respect from even the highest Hymenoptera, which first develop the legs and then reabsorb them before hatching (*Psyche*, June, 1891, p. 98).

The subject of mimicry also throws some light on these relations. As is well known, the Diptera afford many interesting cases of mimicry, and it is important to our theory to notice that they generally imitate the Hymenoptera, especially the very highest forms, such as wasps, humble-bees, and even honey-bees. One of the most widespread of all species, *Eristalis tenax* Linn., is such a good imitation of the honey-bee as to deceive the very elect. One of my students, an enthusiastic collector and well acquainted with this case of mimicry, once grasped a bee in his hand, under the impression that he was capturing one of these flies. Now, on any theory, we must admit that these species of flies are of more recent origin than the species which they mimic. Most of these imitative flies belong to the family Syrphidæ, which is considered to be one of the oldest of the group Cyclorrhapha, comprising the higher flies.

The Diptera, as a whole, are wonderfully rich in peculiar modifications of structure. In almost any organ the variety of forms exceeds that of any other order. Even the antennæ of beetles do not surpass, if they equal, those of flies in this respect. The wings are far more variable in venation than those of any other order. The variety and complexity of organs for grasping the female are almost beyond belief to one who has not seen them.

The one thing which has prevented the recognition of the real rank of the Diptera is a lingering notion that specialization by reduction really brings an insect down to a lower position in the scale. The word "high" suggests the idea of "complete," or "perfect," or "typical." If Professor Hyatt's test were to exclude every other, as it ought to, there could scarcely be any further disagreement on the question of the highest order.

The line of argument here suggested points to the Pupipara as the highest of all insects; nor would I in the least seek to evade the conclusion. Of the group, I have seen only the Hippoboscidæ; among these the sheep tick, *Melophagus ovinus* Linn, appears to deserve the highest rank.

J. M. Aldrich.

DEBLOOMING MINERAL OILS.

It is a common practice with dealers in mineral lubricating oils and what are known as wool-stock and neutral oils to add certain chemicals to these oils to destroy the bluish fluorescence or "bloom." The bloom on ordinary refined kerosene is very noticeable, while paraffin oil, i.e., oil that has been distilled from petroleum tar, or residuum, is intensely blue. A good way to see the bloom of an oil is to view it through the ordinary four-ounce sample bottle. These bottles are made with straight sides and of white glass. A test-tube answers very well. The bottle should be held in front of a window and viewed through the bottom.

If a drop of oil be put on a piece of black glass, or on a piece of window-glass painted black on the bottom, the bloom will show even when the oil appears bloomless in the bottle. The bloom of oils may be destroyed or masked by nitric acid, nitro-benzol, di-nitro-naphthalene, and some other nitro-compounds. The use of nitric acid, of course, destroys the oil for lubricating purposes.

The di-nitro-naphthalene of commerce is a very efficient deblooming agent. I found, however, that if this material be washed in hot water until the free acid and free nitro-benzol (?) be washed out, it loses its deblooming properties.

A small percentage of oil of myrbane added to wool-oil or neutral oil will destroy or mask the bloom altogether. At the same time it, like the di-nitro-naphthalene, darkens the oil, and gives it the odor of benzol.

The usual practice is to add a quantity of di-nitro-naphthalene to a portion of the oil to be treated, warming it gently meanwhile, and then, when the oil is about to be sold, to add this strong solution to the bulk of the oil. This is done because the nitro compound is liable to crystallize out in the cold, and also to stain yellow the containing vessel and to darken the oil on standing.

If a bright piece of steel be put into oil containing much di-nitro-naphthalene the steel becomes corroded. It will be readily seen that such oil is unfit for lubricating purposes. If the oil be filtered while cold, fine crystals of di-nitro-naphthalene will collect on the filter, and at the same time the filter is stained yellow. The bloom reappears in the filtered oil, showing that the bloom was only covered up and not destroyed.

The only safe and proper way to bleach and debloom oil is to expose it to the sun and air for a long time — two or three weeks or so — depending on the weather. By this method no deleterious substances are added to the oil, while at the same time it is rendered sweeter in odor and the "body" is somewhat increased. The bleacher consists of a shallow tank, sometimes covered with glass, but more generally exposed to the sun and rain. Into these tanks a few inches of water is run, and on top of this the oil. Any impurities settle to the bottom of the water, and are left when the oil is drawn off. In some of the larger refineries these bleachers literally cover acres of ground. The great objection to this method of bleaching is the length of time occupied and the immense space taken up by the bleachers.

It may be asked, What is the object of deblooming oils? So far as I can learn the only object is that they may be used to adulterate the more expensive animal and vegetable oils, such as lard, tallow, linseed, and cottonseed oils.

A mixture of lard oil, 75 per cent at 50 cents a gallon, and debloomed neutral oil, 25 per cent at 13 cents a gallon, will pass for pure lard-oil with anyone but an expert. This fraud may be detected by the lower flashing and burning points of the mixture and by the change in specific gravity from that of pure lard oil. The tests mentioned above may also be applied.

D. T. MARSHALL.

Boston, Mass., April 21.

ASTRONOMICAL NOTES.

[*Edited by George A. Hill.*]

Winnecke's Periodic Comet.

IN No. 3,083 of the *Astronomische Nachrichten* Dr. Haerdtl of Vienna publishes corrected elements for Winnecke's periodic comet, and also an ephemeris extending into next September. The comet will reach perihelion on July 1, be the nearest to the earth on July 9, when it will be only 11 million miles from the earth and attain a brightness 140 times that it had when found by Dr. Spetalerou March 18 last. The comet at the date of discovery was 72 million miles from the earth. The epoch of the ephemeris is for Berlin midnight.

	R.A.			Dec.		
	h	m	s		°	′
April 30	11	34	23	+	44	2
May 1		32	42		44	8
2		31	4		44	13
3		29	27		44	18
4		27	52		44	22
5		26	20		44	26
6		24	49		44	29
7		23	11		44	31
8		21	52		44	33
9		20	27		44	34
10		19	3		44	35
11		17	41		44	36
12		16	21		44	36
13		15	3		44	35
14		13	46		44	34
15		12	13		44	33
16	11	11	16	+	44	31

Comet Swift.

The following is a continuation of the ephemeris for comet Swift. This comet may prove to be a very interesting one, as the computations made seem to point to the fact that it is moving in a hyperbolic orbit. The observations at the present time do not extend over a sufficient interval to be absolutely sure of this statement, but as the comet is a bright one, it will probably give us a long series, when the question can be definitely settled. We have so few positive cases of comets moving in hyperbolic orbits that this one will receive at the hands of computers a very thorough discussion. The Rev. G. M. Searle, director of the Observatory of the Catholic University at Washington, has computed both hyperbolic and parabolic orbits for this comet. The difference between computation and observation for the middle places in the hyperbolic orbit is zero, while in the parabolic orbit it is + 15″ in longitude and + 7″ in latitude. The following is a continuation of the ephemeris published in No. 481 of *Science*.

	R.A.			Dec.		
	h	m	s		°	′
May 8	22	53	10	+	25	28
9		55	58		26	6
10	22	58	45		26	42
11	23	1	30		27	18
12		4	13		27	53
13		6	55		28	28
14		9	35		29	2
15		12	14		29	35
16		14	51		30	7
17		17	27		30	39
18	23	20	1	+	31	11

Comet Denning.

The following is an ephemeris for comet Denning. The epoch is for Berlin midnight:

	B.A.			Dec.		
	h	m	s		°	′
May 8	3	11	48	+	55	11
9		15	23		54	57
10		18	54		54	42
11		22	22		54	27
12		25	46		54	12
13		29	7		53	57
14		32	24		53	42
15		35	38		53	27
16		38	48		53	12
17		41	55		52	57
18	3	44	58	+	52	41

MR. PETRIE'S DISCOVERIES AT TEL-EL-AMARNA.

ONLY recently the news reached us of the discovery by the Direction of Exploration in Egypt of the tomb of King Amenhotep IV. (Khu-n-aten) at Tel-el-Amarna; and now, from another quarter, we hear of further important discoveries in the same locality.

The labors of Mr. W. M. Flinders Petrie, who has been working all winter at the excavation of the royal palace of Khu-n-aten, have been rewarded by a most unexpected find, one, indeed, that is unparalleled in the history of archæology. Lying on the ground, tossed in a corner among spoilt blocks of rough granite "Ushabtis," discarded by the artisans who had prepared the king's sepulchral furniture, lay the plaster cast, the mask, of the dead man himself, evidently taken immediately after his death by the sculptors employed to carve his statues. It is in an almost perfect state of preservation.

This extraordinary relic of one of the most interesting figures of antiquity lends unforseen support to the view of the monarch's character suggested in my last article. According to Mr. Petrie, the face thus revealed, as it were, in the flesh, "is full of character. There is no trace of passion in it, but a philosophical calm, with great obstinacy and im-practicability. He was no fanatic, but rather a high-bred theorist and reformer" How vividly clear do such facts as these make the remote past appear; and what deep meaning they lend to the words of that greatest of word-painters, Ernest Renan: "A giant even placed on the confines of a picture still remains a giant."

The palace has been exhumed and the pavements — beautifully frescoed with tanks and fishes, birds and lotus plants, and almost unique in their style — have come to light; also inlaid walls and splendid columns inscribed with scenes and capped with capitals imitating "gigantic jewelry." Their surface was encrusted with brilliant glazes, and the ridges between these were gilt, so that they resembled gems set in gold, the effect thus produced reminding the explorers of the "net-work" of the "Temple of Solomon."

Mr. Petrie was also fortunate enough to come across smaller objects, which have thrown light upon the history of the period. In a neighboring quarry he found the name of Queen Thii, the mother of Khu-n-aten, unaccompanied by that of a king. This fact has given him good ground for the suggestion that she may have governed alone during the minority of her son, who, to all appearances, was only married in the fifth year of his reign, his first child having been born in his sixth year. In the fifth year of his reign the king was still called Amenhotep, as shown in a papyrus found at Gurob, but in his sixth year he appears at Tel-el-amarna as Khu-n-aten; so that the great schism which led to the final rupture between himself and the Theban priesthood must have occurred between those two dates.

Moreover, Mr. Petrie has in his possession a scarab on which Amenhotep is represented in adoration before Aten, the name of Amen having been subsequently erased. This scarab finally settles the question, so often raised, of the identity of the man who bore both names.

Relics of the successors of Khu-n-aten — Ra-Saa-Ka-Khepru, Tut-Ankh-Amen, Aï — were also recovered at Tel-el-amarna, showing them to have resided there after him; and even Hor-em-heb left a block of sculpture inscribed with his "cartouche" in the temple of Aten, probably in the early part of his reign and before his compromise with the conservative Theban party. After that time the site was apparently abandoned and no traces remain of further occupation.

The cuneiform tablets discovered in 1887 were all in storerooms outside the palace, near the house of the Babylonian scribe, which Mr. Petrie identified by finding the "waste pieces of his spoilt tablets in rubbish holes."

A large quantity of Ægean pottery similar to the Mykenæ and Ialysos type was found, of even greater variety of form than that recovered at Gurob. And this as well as the naturalistic character of the frescoes, which Mr. Petrie compares with those of Tiryns and with the gold cups of Vaphio, and the geometrical patterns that decorate some of the columns, which in his opinion closely approach the art of the Mykenæ period, are highly suggestive of Greek intercourse and influence.

The court of Khu-n-aten, in the fifteenth century B.C., must have been a remarkable one. Under the quickening influence of a great mind the foreign conquests of the warlike monarchs of the eighteenth dynasty seem to have been made to yield the richest fruits of peace. A wide-spread intercourse had been established among nations; Phœnicians, Syrians and Mesopotamians, Greeks and Mediterranean Islanders are revealed to us as having come into the Nile valley, bringing along with their commerce their arts, their industries, and various indirect influences. No wonder that the priests of Amon saw with dread and aversion the influx of foreigners who, encouraged by the evident cosmopolitanism of their king, bid fair to revolutionize the ancient traditions of their venerable land and to remove the narrow boundaries of Egyptian conservatism. S. Y. STEVENSON.

THE ROLLING OF SHIPS.[1]

ONE fact that often strikes the thoughtful traveller by sea is that, notwithstanding the great and numerous improvements of recent years which have made life on shipboard pleasant and luxurious, little or nothing has been done to steady a vessel when she meets with waves that set her rolling heavily from side to side. The tendency seems to be rather in the direction of increased than of diminished rolling; for the steadying influence of sails, which makes the motion so easy and agreeable in a sailing ship, is fast disappearing in large steamers. Masts and sails add appreciably to the resistance of large fast steamers; so they have been cut down in size year by year till such fragments of sail as still remain are so small compared with the size of the ship as to retain little power to reduce rolling.

Shipowners and seamen do not show much sympathy with the discomfort and misery that rolling causes to most passengers. They perhaps get anxious about an occasional vessel that acquires the evil reputation of being a bad roller, because passengers may be frightened away and the receipts fall off in consequence; but beyond wishing, or attempting, to deal with abnormal cases, nothing seems to be thought of. Rolling is considered incurable, or as not of sufficient importance to trouble about. Yet there is nothing which would contribute so directly to the comfort of landsmen at sea, or do so much to change what is for many misery and torture into comfort, as to check and reduce as far as possible the rolling proclivities of ships.

The laws which govern rolling are now well understood, and it is strange that this knowledge has not enabled an effective means of control to be devised. What is stranger still is that well-known means of mitigating rolling — such as the use of bilge keels — are employed in but very few cases. A ship rolls about a longitudinal axis which is approximately at her centre of gravity, and the rolling is practically isochronous at moderate angles in ordinary ships. The heaviest rolling occurs when the wave-period synchronizes with the natural period of oscillation of the ship. Many vessels are comparatively free from rolling till they meet waves of this period, and if such meeting could be avoided, excessive rolling could be prevented. Some vessels have periods as long as fifteen to eighteen seconds for the double oscillation, and as these would require to meet with waves 1,300 to 1,500 feet in length, in order to furnish the conditions of synchronism, it is seldom that they suffer from heavy or cumulative rolling. Such waves are, however, not rare in the Atlantic.

The limits of heavy rolling are fixed, of course, by the resistance offered by the water and air to the transverse rotation of the ship, which is very great because of the large areas that directly oppose motion in a transverse direction. But for this resistance, and the condition that rolling is only isochronous within moderate angles of inclination, a few waves of the same period as that of a ship would capsize her.

[1] From Nature.

The two most obvious modes of preventing heavy rolling are, therefore, (1) to make the period of rolling of a ship as long as possible, so as to reduce the chances of meeting waves whose period will synchronize with it, and (2) to increase the resistance to rolling. The period of a ship varies directly as her radius of gyration, and inversely as the square root of her metacentric height. Hence the period may be increased by increasing the moment of inertia of the ship, or by decreasing the metacentric height. In armored war-vessels the moment of inertia is large, on account of the heavy weights of armor on the sides, and the heavy guns that are either placed at the side or high up above the centre of gravity. Ordinary steamers have no such weights concentrated at great distances from the centre of gravity, and their moments of inertia are determined by the distribution of material in the hull that is fixed by structural conditions and by the stowage required for their voyages. Metacentric height cannot be reduced below a certain amount, which is necessary to prevent too easy inclination of the ship, or crankness, in still water. On the whole, we may regard the longest periods that the largest ships are likely to have with advantage to be about those named above, i.e., fifteen to eighteen seconds.

Length of period cannot give immunity against occasional heavy rolling; but increase of resistance reduces the angles of roll at all times, and especially when the angular velocity is greatest and the rolling is worst. Such resistance is furnished by the frictional resistance of the bottom of a ship and by the direct resistance of projecting parts of the bottom, such as the keel and the large flat surfaces below at the stem and stern. This resistance can be largely increased by means of bilge keels. The value of bilge keels is recognized in the Royal Navy, and the ships of the navy have been fitted with them for many years with highly beneficial results. The advantage of bilge keels was proved beyond all doubt many years ago by careful experiments made in this country and in France; and the late Mr. Wm. Froude showed, by the trials he made of H.M.S. "Greyhound" twenty years ago, that bilge keels of excessive size — 3 feet six inches deep, and 100 feet in length, on a vessel 172 feet long — had only an insignificant effect upon speed throughout great differences of trim.

It is strange that the mercantile marine should not yet have adopted bilge keels, and obtained the undoubted advantage they give in steadiness. The number of ships that have them is comparatively few. There is an almost universal opinion and prejudice against their use, and the largest and finest passenger steamers have no bilge keels. This is in spite of the fact that, in cases where bilge keels have been fitted to try to check heavy rolling — and they have been of suitable size and properly placed — it has been found that the angles of rolling have been reduced by nearly one-half. There is a prevalent belief — which has no foundation in fact — that bilge keels are very detrimental to speed. We have said that Mr. Froude's experiments showed the contrary, even on trials made in still water; but it appears certain that at sea any trifling loss of speed which still-water trials might show would be more than compensated for by gain in speed when the vessel is prevented from rolling through large angles from side to side, and undergoing great changes of underwater form at every roll. Experience with ships that have had bilge keels added after running for some time without them shows that there has been no appreciable difference of speed or increase of coal consumption on their voyages.

Another, and a more heroic, method of stopping or reducing rolling would be to counteract the inclining moment of the ship caused by the ever-changing inclination of the waves by an equal and opposite moment, which would vary as the inclining moment varies. This has been attempted at different times and in various ways. It is essential to any degree of success, however, that the opposing moment brought into operation should be completely under control, so as always to act in the manner and to the extent required. The attempts to obtain a steady platform by freely suspending it, and making it independent of the rolling of the ship, have failed — apart from the practical difficulties of carrying out such an arrangement on a large scale — because the point of suspension oscillates when the ship rolls, and the platform acquires a rolling motion of its own. Weights, made of heavy solid material, which move from one side to the other of a ship subject to the action of gravity and rotation, fail because they cannot be made to act continuously in the manner required.

A degree of success has been achieved by admitting water into a suitably prepared chamber and leaving it free to move from side to side as the ship rolls. This has been done in several ships of the navy, the case of the "Inflexible" being that which was the most carefully experimented upon. The movement of this internal water follows the inclination of the ship, but it lags behind, and thus tends to reduce the inclination. Its effect can be regulated by the quantity of water admitted into the chamber and by its depth. The "Inflexible" committee state in their report that comparatively small changes in depth increase or diminish largely the extinctive power of the water. For various reasons — one of which is that while such a chamber is very effective in a moderate sea it fails in a rough sea when the rolling of the ship is greatest — and perhaps partly on account of the destructive and disturbing effect of 100 tons or more of water rushing from side to side of a ship over sixty feet wide — these water-chambers appear to have gone out of use in the navy, and they have been given up in the "City of New York" and "City of Paris," which vessels were said to be fitted with them when first built and placed upon the Atlantic.

Mr. Thornycroft has devised a means of checking rolling by moving a weight, under strict control, from side to side of a vessel so as to continuously balance, or subtract from, the heeling moment of the wave-slope. It consists of a large mass of iron in the form of a quadrant of a circle, which is placed horizontally, with the centre on the middle line of the vessel, and there connected with a vertical shaft. The shaft is turned by an hydraulic engine, which is very ingeniously controlled by an automatic arrangement. The heavy iron quadrant is swept round from side to side, revolving about its centre, to the extent that is required to counteract the heeling moment. In a paper read on the 6th instant before the Institution of Naval Architects, Mr. Thornycroft said: —

"The manner in which the controlling gear works will be better understood if we imagine a vessel remaining upright among waves, while near the centre of gravity of the ship we place a short-period pendulum suspended so as to move with little friction; this will follow the change in the apparent direction of gravity without appreciable loss of time, so that any change in the wave-angle and apparent direction of gravity cannot take place without due warning, which will indicate the time and amount of the disturbance. It is therefore only necessary to make the motion of the ballast bear some particular and constant ratio to the motion of this short-period pendulum to keep the balance true. The inertia of a heavy mass will cause some loss of time, as we can only use a limited force for its control; but it is possible to accelerate the phase of motion and overcome this difficulty so far as to get good results.

"If, now, we imagine the ship to roll in still water, the effect of the combination just described will be to balance the ship's stability for a limited angle; but this defect is removed by the introduction of a second pendulum of long period, which tends to move the ballast in the opposite direction to the first one, and enables the apparatus to discriminate between the angular motion of the water and that of the vessel.

"I find, however, that the long-period pendulum is rather a delicate instrument, and that its function can be served by a cataract arranged so as to always slowly return the ballast to the centre, and this device has the effect of accelerating the phase of motion, which, in some cases, we also require.

"We are therefore able, by very simple parts, to construct an apparatus which will indicate the direction and amount of motion necessary to be given to the ballast at a particular time so as to resist the wave effort; this power of indicating may be converted into one of controlling by suitable mechanism. The loss of time due to inertia of the necessary ballast is not always unfavorable when the apparatus has to extinguish rolling motion, the greatest effect being obtained when the ballast crosses the centre line of the ship at a time when it is most inclined to the water surface, and this corresponds to a quarter of the phase behind the motion of the short pendulum."

The apparatus has been working for some time in the steam yacht "Cecile" with very good results. What the objections may be to applying it to the largest passenger steamers remains to be seen. A moving weight of something like 100 or 150 tons would probably be required in such vessels. The power necessary to control the movement of the weight appears to be small, and Mr. Thornycroft's invention seems at any rate to show the way towards obtaining the long-desired boon of substantially reducing, if not checking altogether, the rolling of ships. If it succeed in doing upon a large scale only a portion of what is claimed for it in the way of anticipating and counteracting the heeling effect of waves, without the possibility of acting in an erratic or undesirable way, we may hope to see it adopted some day in passenger steamers.

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.*

On request in advance, one hundred copies of the number containing his communication will be furnished free to any correspondent.

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

A Fire-Ball.

A TELEPHONE wire was supported on cedar posts 20 feet high and 20 rods apart. During last August [1889] we had a thunderstorm, during which there was a sharp and heavy crash. Several of the poles were found to have been struck, and portions to have been taken out through their entire length. One of these portions, of the size of a medium rail, was thrown into an adjoining field some rods from the pole. Portions from the others were smaller and more or less shattered. Near the southernmost pole struck, a family were in a house with doors and windows open, and a luminous ball seemed to leap from the wire, pass through the open door and a window, and pursue its course some rods through the open space behind the house. A boy in the room grasped his thumb and cried out, "I'm struck," and Mr. Hewett felt a sensation of numbness in his left arm for some time. A girl seized her shawl and rushed out of the house to chase the ball. She reported that she pursued it some distance, while it bounded lightly along, until it seemed to be dissipated in the air without an explosion. The size of the ball was about that of the two fists, and its velocity about that of a ball thrown by the hand.

C. C. BAYLEY.

Lightning.

THE account of a stroke of lightning in *Science* for Jan. 29 last and the article in the issue of April 8 on "The New Method of Protecting Buildings from Lightning" call attention to a subject which has been greatly neglected, viz., the nature, characteristics, and effects of lightning strokes. Besides the passage of the electricity from the cloud to the earth, or the reverse, heavy discharges are always accompanied by other phenomena, which vary on different occasions, and which, for want of record and tabulation, have not yet been explained and their laws determined. In the loose accounts given of them in our daily journals they are spoken of as "freaks of lightning," and no further notice is taken of them. In the hope of doing something towards making a careful record, I offer the following, which has never been published.

The village of Amherst, Mass., is supplied with water from a reservoir among the Pelham hills, about five miles distant. The aqueduct runs nearly in a straight line from east to west. The pipes are made of thick sheet-iron bent into tubes, and the overlapping edges are riveted together with copper rivets about two inches apart. They are covered both without and within with a thick coat of cement. The joints are filled with cement so that the irons do not come in contact, an iron ring five or six inches broad is slipped over the joint, and the whole covered with cement. At a place about half a mile west of the reservoir the aqueduct runs near the foot of a steep hill that is seventy or eighty feet high and covered with a recent growth of white pine, shrub oaks, and yellow birch from ten to thirty feet in height, the intervals of the trees being filled with bushes. During a very heavy shower in July, 1884, a thunder-bolt was seen to fall on the hill. It struck a pine tree half-way down the side of the hill, whose top, on a horizontal line, was not more than two rods from the bottom of the trees on the summit. The tree struck was about twenty-five feet high and eight inches in diameter at the butt. The lightning did not apparently strike it on the top, but about one-fourth of its height from the top, at three equidistant points on the circumference the bark began to be ruptured, and the ruptures continued in straight lines to the ground. There the three currents united, ran over the ground, scattering the dirt and leaves in all directions for two rods, until it came over the aqueduct. There it bored a hole an inch in diameter down to the pipes. It struck about the middle of one of the lengths, broke the cement, and indented the iron as with a heavy blow of a sledge-hammer. The surface of the indentation appeared to have been melted. The current then turned to the west, ran along the top of the pipes, which were full of water under heavy pressure, stripped off the cement and slit the iron tubes through the whole, or a part, of their length. When a line of rivets came in its path, it cut them off between the overlapping edges of the iron as smoothly as with a knife, leaving the parts in each edge undisturbed. At the joints it rent off rings and cement, and indented the edge facing the current, melting the surface as in the place where it first struck the pipe. Rarely was the edge from which the current flowed indented. These effects continued for more than a mile, growing less and less, and finally disappeared.

Several questions in this connection require solution.

1. If the discharge is simply the equalizing of the potential between the cloud and the earth, why was that not accomplished as

soon as the current reached the ground, the wet earth being a good conductor?

2. Why did not the lightning strike the trees on the summit rather than one several feet below, and why not the top of the latter?

3. Why did it indent the pipes, and why the edges facing the current rather than the other? Is electricity material? Can anything not material manifest such a *vis viva* or working energy? Why was the iron melted when electricity has no inherent heat?

4. Do not the effects at the junctions of the pipes indicate a sort of damming up of the current by the cement until the pressure became sufficient to burst the barrier, and then it struck the following edge with its accumulated flood?

MARSHALL HENSHAW.

Amherst, Mass., Apr. 21.

[The phenomena presented in lightning strokes have heretofore appeared so lawless that it may be well to call attention to the fact, which has been repeatedly observed, that but little damage is generally done to portions of trees on the same levels as the foliage. It has also been observed that the presence on any level of a conductor of considerable surface, and consequent large electrical capacity, mitigates the effects on that level. Whether the large conducting surface presented by the wet leaves of a tree is a parallel case is, of course, a question; but the fact as stated is among those well authenticated in regard to lightning effects.—ED.]

Periodicity of the Aurora.

ON Saturday night, April 23, there was a fine Aurora seen in this locality whenever the clouds broke away until after midnight. This display is specially interesting because it is the sixth consecutive return of an aurora at the precise interval of twenty-seven days, the dates being as follows: Dec. 9, Jan. 5, Feb. 2, Feb. 29, March 27, and April 23. The display will be due again upon May 20. It has been associated with reappearances at the sun's eastern limb of an area south of the equator which has been much frequented by spots and faculæ. In like manner a record now before me shows that reappearances at the eastern limb of disturbed areas in the sun's northern hemisphere have their chief magnetic effect during the autumn months. From this it would seem that in order that a solar disturbance may affect the earth's magnetism it must be in a particular location, namely, at the eastern limb and as near as possible to the plane of the earth's orbit. Certainly such disturbances do not have their magnetic effect promiscuously in all locations, or at present we should have auroras and magnetic storms continuously, which is very far from being the case.

M. A. VEEDER.

Lyons, N.Y., April 25.

CALENDAR OF SOCIETIES.

Philosophical Society, Washington.

April 23.—G. M. Searle, On a Simple Form of Double-Image Micrometer; Arthur Keith, The Geology of Chilhowee Mountain in Tennessee; B. E. Fernow, Timber Physics.

Chemical Society, Washington.

April 14.—Wm. H. Krug, On Behavior of Acetone and Carbo-Hydrates; F. W. Clarke, On the Decomposition of Certain Silicates by Heat; Thomas Taylor, Smokeless Powder.

Publications Received at Editor's Office.

BRYANT, WILLIAM C. Sella, Thanatopsis and other Poems. Boston, Houghton, Mifflin & Co. 16°, paper. 95 p. 15 cts.
GORE, J. HOWARD. A German Science Reader. Boston, D. C. Heath & Co. 12°. 196 p. 80 cts.
MILLER, OLIVE THORNE. Little Brothers of the Air. Boston, Houghton, Mifflin & Co. 12°. 271 p. $1.25.
POSSE, NILS. Handbook of School Gymnastics of the Swedish System. Boston, Lee & Shepard. 18°. 192 p. 50 cts.
WEED, CLARENCE M. Spraying Crops. New York, Rural Pub. Co. 16°. 110 p. Ill.

Exchanges.

[Free of charge to all, if of satisfactory character. Address N. D. C. Hodges, 874 Broadway, New York.]

For sale or exchange, Das Ausland, 10 vols., 1882 to 1891, including 6 vols. bound, 4 in numbers. Wheeler Survey, vol. 1, Geog. Report; also vol. 6, Botany; Production of gold and silver in the United States, 1880, '1, '2, '3, '5; Selfridge Isthmus of Darien. Will sell at very low prices. J. F. James, 1443 Corcoran St., Washington, D. C.

For exchange.—A fine thirteen-keyed flute in leather covered case, for a photograph camera suitable for making lantern slides. Flute cost $27, and is nearly new. U. O. COX, Mankato, Minn.

To exchange; Experiment Station bulletins and reports for bulletins and reports not in my file. I will send list of what I have for exchange. P. H. ROLFS, Lake City, Florida.

Finished specimens of all colors of Vermont marble for fine fossils or crystals. Will be given only for valuable specimens because of the cost of polishing. GEO. W. PERRY, State Geologist, Rutland, Vt.

For exchange.—Three copies of "American State Papers Bearing on Sunday Legislation," 1891, $2.50, new and unused, for "The Sabbath," by Harmon Kingsbury, 1840; "The Sabbath," by A. A. Phelps, 1842; "History of the Institution of the Sabbath Day, Its Uses and Abuses," by W. L. Fisher, 1859; "Humorous Phases of the Law," by Irving Browne; or other works amounting to value of books exchanged, on the question of governmental legislation in reference to religion, personal liberty, etc. If preferred, I will sell "American State Papers," and buy other books on the subject. WILLIAM ADDISON BLAKELY, Chicago, Ill.

Wanted, in exchange for the following works, any standard works on Surgery and on Diseases of Children: Wilson's "American Ornithology," 3 vols.; Coues' "Birds of the Northwest" and "Birds of the Colorado Valley," 2 vols.; Minot's "Land and Game Birds of New England;" Samuels' "Our Northern and Eastern Birds;" all the Reports on the Birds of the Pacific R. R. Survey, bound in 2 vols., morocco; and a complete set of the Reports of the Arkansas Geological Survey. Please give editions and dates in corresponding. R. ELLSWORTH CALL, High School, Des Moines, Iowa.

To exchange Wright's "Ice Age in North America" and Le Conte's "Elements of Geology" (Copyright 1882) for "Darwinism," by A. R. Wallace, "Origin of Species," by Darwin, "Descent of Man," by Darwin, "Man's Place in Nature," Huxley, "Mental Evolution in Animals," by Romanes, "Pre-Adamites," by Winchell. No books wanted except latest editions, and books in good condition. C. S. Brown, Jr., Vanderbilt University, Nashville, Tenn.

For Sale or Exchange for books a complete private chemical laboratory outfit. Includes large Becker balance (200g. to 1-10mg.), platinum dishes and crucibles, agate motors, glass-blowing apparatus, etc. For sale in part or whole. Also complete file of *Silliman's Journal*, 1862-1885 (62-71 bound); Smithsonian Reports, 1854-1883; U. S. Coast Survey, 1854-1869. Full particulars to enquirers. F. GARDINER, JR., Pomfret, Conn.

Wants.

Any person seeking a position for which he is qualified by his scientific attainments, or any person seeking some one to fill a position of this character, be it that of a teacher of science, chemist, draughtsman, or what not, can have the 'Want' inserted under this head at 10 cents a count line. Nothing inserted at less than 50 cents a time prepaid by stamps, if most convenient.

TRANSLATOR wanted to read German architectural works at sight (no writing). One familiar with technical terms desired. Address "A.," Box 149, New York Post Office.

WANTED.—A position in a manufacturing establishment by a manufacturing Chemist of inventive ability. Address M. W. B., care of *Science*, 874 Broadway, N. Y.

WANTED.—Books on Anatomy and Hypnotism. Will pay cash or give similar books in exchange. Also want medical battery and photo outfit. DR. ANDERSON, 182 State street, Chicago, Ill.

WANTED.—A college graduate with some normal training, to teach the sciences, at $1,800 per year, in a Southern college. A Baptist or a Methodist preferred. Must also be a first-class Latin scholar. A. H. Beals, Box K, Milledgeville, Ga.

A PROFESSORSHIP in Chemistry is wanted by one who has had five years' experience in that capacity. Would prefer to give instruction by lectures and experiments rather than by text-book methods. Would like a position in a college or university where there is a good student's laboratory. Special points of strength claimed are: (1) Thorough control of a class and good order during lectures and recitations. (2) Accuracy in experimenting with chemicals and skill in the manipulation of chemical apparatus. The permission of several distinguished educators has been given to refer to them if required. Would not care to accept a position paying less than $1,500. Address B. E., care of *Science*, Advertising Dept., 47 Lafayette Place, New York.

ADDRESS WANTED.—Will some one please send the address of the Secretary of the American Philological Society. Also that of Herbert Spencer. "ADDISON," Room 84, 164 Madison St., Chicago, Ill.

ADDRESSES of Old Book Dealers wanted.—Wishing to obtain a number of old books out of print, I very much desire the addresses or catalogues of rare second-hand book dealers. If there is a directory or list of such dealers I should like to obtain possession of one. W. A. BLAKELY, Chicago, Ill.

WANTED.—(1) A white man versed in wood and iron working, able to work from specifications and plans, suited for an instructor of boys; his business to have charge of shops of school, outline and direct the work for foremen and students; salary to be $1,000 per annum (nine months). (2) A man (black preferred) to teach the colored, iron working and forging, subordinate to the preceding; salary, $720. (3) A man (white) competent to take classes in engineering (assistant's position), but with the ability to perform any of the work required in any of the ordinary engineering courses of our universities; salary from $1,000 to $1,500. A. H. BEALS, Milledgeville, Ga.

AMONG THE PUBLISHERS.

Babyhood continues in its May issue the medical articles on catarrhal affections and their complications in children, and the treatment of the headaches of childhood.

— The recent discussion over Jewish immigration to this country imparts a timely interest to Mr. Joseph Pennell's volume entitled "The Jew at Home." This artist has visited and studied the Jewish towns of the Austro-Hungarian Empire, and the results of his observations will be found both in his text and in a series of illustrations. "The Jew at Home" will be published immediately by D. Appleton & Co.

— *The Chautauquan* for May presents the following among other articles: "Physical Culture," IV., by J. M. Buckley, LL.D.; "The United States Patent Office," Part I., by Helen Frances Shedd; "The Natural History of Plants," II., by Gerald McCarthy; "Flower Shows in the United States," by Samuel A. Wood; "Phrenology," by Garrett P. Serviss.

— In *Lippincott's Magazine* for May, Mr. Floyd B. Wilson has a paper on "Personal Economics in our Colleges," and Mr. Philemon Hemsley, in "After-Dinner Botany," traces the relationship between certain edible and other plants not usually connected in our thoughts.

— Professor Jowett's translation of "The Dialogues of Plato," the second edition of which has been for several years out of print, will appear in May in the third edition, forming five 8vo volumes. The work has been revised and corrected throughout and in great part rewritten. Macmillan & Co, the publishers, have copyrighted the new edition by resetting the entire work in this country.

SCIENCE

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SCIENCE

NEW YORK, MAY 6, 1892.

PRELIMINARY NOTE ON THE RELATIONS OF THE MOTOR MUSCLES OF THE EYES TO CERTAIN FACIAL EXPRESSIONS.

In the course of some years of close observation of the anomalies of the muscles which govern the movements of the eyes, the fact that remarkable changes often follow the modification of the conditions of these muscles led me not only to regard with greater care these facial changes, but to bring to the subject the aid of photography, by which means only these expressions could be accurately registered. Photographic portraits giving a direct front-view of more than two thousand persons have thus been made. In each case a record, as full and as accurate as I have been able to obtain, of the state of these eye muscles has been made, and in the majority of the cases careful observations have been repeated many times during some weeks or months.

We have thus, for the first time, a series of observations in which the facial expressions are registered by photography, while painstaking determinations of the ocular-muscle conditions are faithfully recorded.

Beyond this, in a great number of instances, photographs have been taken at various stages of modification of these muscles, thus affording a comparative study of the face under varying conditions of the eye muscles.

The result of this study has been to demonstrate that certain well-defined types of facial expression are not only associated with but are dependent upon certain relative tensions of the oculo-motor muscles.

An elementary knowledge of the conditions of these muscles, as commonly presenting themselves in practice, is necessary to an understanding of what follows.

In an ideal condition of the eye muscles, they should, when the minimum of effort of all the opposing forces is exercised, so adjust the eyes that the lines of vision will be practically parallel. More exactly, the adjustments should be such that the visual lines would meet only at a point situated at a very considerable distance in front of the eyes.

This condition of perfect equilibrium of all the opposing eye-muscles does not always exist. Indeed, such a condition is the exception. (In this statement no reference to the conditions known as strabismus or squint is intended; in fact, in this connection all such exaggerated anomalies are left absolutely out of consideration, the purpose being to consider only the conditions in which single vision with the two eyes is maintained).

The condition of equilibrium above described is known as *orthophoria.*

In case of a normal excess of tension on the part of the muscles which rotate the eyes inward, the visual lines, should no restraining force be brought into action, would drift toward each other and visual confusion would result. In that case, by means of a voluntary but unconscious effort on the part of the opposing muscles, the lines of vision might be properly adjusted. This condition, in which there is a normal tendency of the visual lines to approach, but in which there is ability to restrain that tendency, is known as *esophoria.*

The opposite condition, in which the normal tension of the muscles which rotate the eyes outward predominates and which, if unrestrained, would cause the visual lines to diverge, is known as *exophoria,*

Another condition, in which a tendency of one of the visual lines to rise above its fellow is found, is known as *hyperphoria.*

Compound conditions called *hyperesophoria* and *hyperexophoria* are also found. The terms suggest the elements of these conditions.

In the great majority of persons, some one of these so-called anomalies is to be found. While the condition of absolute orthophoria is, perhaps, not to be expected, that of a near approach to it is sometimes, although exceptionally, found.

The conditions of esophoria and of exophoria are much more common. Hyperphoria would appear to be somewhat less common than the last two.

With each of these conditions of relative tensions of the eye muscles is commonly associated a type of expression

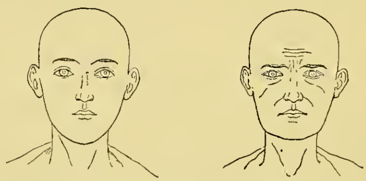

FIG. 1. FIG. 2.

sometimes slightly but often extremely well marked. That there are found apparent exceptions to this rule, as to most other rules, is true. Yet the law is so generally prevalent as to enable us to classify nearly all faces by its assistance.

The great elasticity of muscles, together with the peculiar characteristics of the sub-dermal tissues in childhood and early youth, and the loose and wrinkled character of the skin in advanced age, to a greater or less degree disguise the characteristic expressions arising from these various muscular tensions. The types are therefore most conspicuous in early adult and in middle age.

In the accompanying diagrams, I have endeavored to illustrate the peculiarities of four principal types of facial expression as governed by the eye muscles.

With the state of equilibrium of these muscles, orthophoria (Fig. 1), the expression is one of greater repose than with any of the other states of the eye muscles. The eyebrows, which constitute one of the most striking of all the facial features, form each a moderate and regular curve, marking the border of the orbit, the lower border of the brow corresponding to the orbital border. The inner extremity descends towards the nose, but does not turn downward into the depression bounded by the nose and the orbit. There is no sharp turn or sudden increase of curve at either extremity. The mouth is nearly horizontal or curving very slightly upwards at the centre. The lips in repose are firm but not compressed, and the upper one is well proportioned. The chin is rounded, neither square nor pointedly oval. The lines of the forehead are not usually conspicuous. The naso-labial lines curve outward beyond the angles of the mouth, less horizontally than with esophoria, and less vertically than with exophoria. The curved line below the lower lid is nearly in exact conformity with the curve made by the fold of the upper eye-lid when it is moderately raised.

The absence of special tensions of the facial muscles, in this well-balanced face, permits a quick and easy play of the features, and the habitual absence of any forcible regulation of the eyes or of the face is conducive to a mental equilibrium and to physical endurance.

With esophoria (see Fig. 2) the brows are compressed, often flattened. The extremities often curve suddenly downwards, the inner extremity sinking into the depression bounded by the nose and orbital border. The eyelids are, in a considerable proportion of cases, not as fully opened as in orthophoria, and much less separated than in the typical cases of exophoria. Two rather strong vertical lines making each an angle with the inner extremity of a brow extend upward nearly parallel, upon the forehead, as shown in the

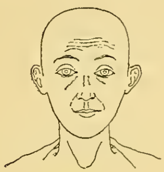

FIG 3.

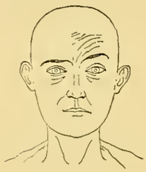

FIG. 4.

diagram. The upper lip is usually short, and the curve of the centre of the mouth upward is often pronounced. The lips are firmly compressed in repose, but in young persons with deficient physical force, the lips may be habitually open. The chin is broad and the naso-labial lines make a wider excursion outward than in orthophoria. The expression in moderate esophoria suggests firmness of character and resolute purpose.

With exophoria (see Fig. 3) the brows are usually strongly arched, often drawn upward upon the forehead, the inner extremity being often removed above and away from the nose. The lines running upward from the side of the nose, when present, are likely to diverge as they ascend. The transverse lines of the forehead are often conspicuous and are higher on the forehead than those which occur with esophoria. The upper lip is long, the centre of the mouth curves downward and the chin is pointedly oval. The facial lines are more vertical than with either of the conditions described, giving to the face the suggestion of length. The lips are not compressed and are liable to be loose and slightly open.

The expression of exophoria suggests more of idealism than of determinate purpose.

Hyperphoria is characterized by irregular features (Fig. 4). The tendency of one visual line to rise above the other demands a restraining effort in which the facial muscles often take an important part. On the side, the visual line of which tends to rise above the other, the brow is depressed, while the brow of the side whose visual line tends downward is elevated. Thus the brow and neighboring tissues of one side aid in depressing the front of the eye, while, on the other hand, by the elevation of the opposite brow less demand is made upon the muscle which is required to rotate its eye upward.

These contrary actions demanded by the relations of the visual lines in hyperphoria affect the whole face, resulting in a want of harmony of the two sides. The angle of the mouth, on the side on which the brow is depressed, is drawn upward, while the other angle is depressed. Thus one side of the face is longer than the other. On one side, the lines of esophoria are found, and on the other, those of exophoria.

In the sketch here given no attempt has been made to describe all the various gradations between these types nor to explain the exceptions. It has been the purpose of this communication only to present the general characteristics of some of the most typical forms of expression which have their origin in the efforts to adjust the eyes.

GEORGE T. STEVENS, M.D.

New York.

THE ARCHITECTURAL EXHIBITION IN BROOKLYN.

THERE is no question but that we stand upon the verge of a great popular revival of interest in architecture. Architectural books and magazines command wide circulations and numerous purchasers. Vast sums of money are yearly expended in building—call it architecture if you will. Exhibitions of architectural drawings have become regular features of winter life in the larger cities. On all hands greater interest is being manifested in the art than ten or twenty years ago seemed possible.

To Brooklyn belongs the credit of having supported the only popular organization for the study of architecture in the country. Professional and student bodies perform a very different function than that which naturally belongs to an institution resting upon non-professional and popular bases. The Brooklyn Institute of Arts and Sciences, especially under the direction of its present efficient head, Prof. Franklin W. Hooper, has achieved a national reputation. An organization that maintains forty-five distinct courses of public lectures, numbering on an average 400 annually, must be reckoned among the most powerful intellectual forces in the country, a power which is not limited by the fact that it confines its operations to the city of Brooklyn.

It is quite in keeping with the progressive policy of the Institute that it should provide the citizens of its native city with an exhibition of architectural drawings, which is noteworthy not only as an evidence of progress on the Institute's part, but as being the most ambitious attempt of the kind yet made in Brooklyn. First attempts are always liable to leave something to be desired, but the Brooklyn Exhibition, which has just closed, was so good on the whole that little fault may be found with it. On the contrary the gentlemen having the matter in charge are to be thoroughly congratulated on succeeding so well. Whatever faults may be found with the exhibition are faults inherent in all architectural exhibitions as a class, and are by no means limited to Brooklyn alone.

And this chief fault is the matter of the exhibition. There is no important subject on which such erroneous views prevail as on architecture. This is a fact that requires no argument. It follows as a natural consequence, therefore, that every time the architects attempt to initiate the public into the mysteries of their art that all possible misunderstandings be avoided; certainly that they themselves make no effort to mislead those they would instruct. Yet an architectural exhibition that consists only of exteriors not only fails in giving the public a true insight into what architecture really is, but is actually, though not intentionally, a deliberate deception. Every architect knows that the designing of the facade is not the only thing he has to do in designing a building; why, then, should he not let the public know what he does and how he does it, and make his exhibitions practical schools in practical architecture, instead of simply exhibitions of facades, or pretty or ugly things — for such is the way of architecture — as the case might be.

When many older bodies fail in this respect, and keep on failing year after year, it is not to be expected that the Brooklyn Institute should make a beginning by inaugurating this much needed reform. As architectural exhibitions go the first attempt was a very good one, but it is well to keep in mind that it was not, really, an architectural exhibition, but an exhibition of facades. While this is perfectly true it contained, for its size, rather more detail drawings of a certain kind than have many more ambitious undertakings. There are several plans for the Protestant Episcopal Cathedral in New York with sections and other details, and a group of detailed drawings in the competition for the Brooklyn Savings Bank are especially attractive for the full manner in which they illustrate their subject. The greater the proportion of such drawings in our architectural exhibitions, the greater their success, and the more will the people realize the true nature and uses of architecture.

In the introduction to the catalogue the Brooklyn Institute lays down a wise programme, "occasional gatherings of the best results and suggestions." The programme is wise enough, and right enough, but unfortunately it is one of those things that can never be carried out. It depends, of course, upon the meaning attached to the word "best." If it is used in the sense of good, it is an unwise limitation, since an architectural exhibition that would consist only of the best of good buildings would be extremely limited. If it is used in the sense of the best that modern work affords it is simply repeating what would evidently follow from an exhibition arranged by architects. Unfortunately, no architectural exhibition can consist only of the best buildings; there is so much that cannot be classed as such that a too rigid scrutiny would deprive such a collection of many important examples of the newest work. Unfortunately, too, it is also true that the importance of an enterprise is no criterion for the excellence of its architecture. New York has seen many noteworthy structures erected which were disgraces both to the architects and those financially responsible for them. Even the Brooklyn exhibition contained drawings of large undertakings which all lovers of a higher architecture must regret to see carried into execution.

Some things necessarily hamper exhibition committees. The public naturally expect to see drawings of great buildings in first-class architectural exhibitions, and it is for the public the exhibitions are held and from it their support should come, if it does not. It is simply one of the architectural conditions that cannot be ignored and that will lower the standards of our architecture and our architectural exhibitions until a broader and more discriminating taste is manifested in the people generally. Then indeed will architectural exhibitions be a success and a pleasure, a source of instruction and delight, a record of past progress, and an inspiration to newer conquests. BARR FERREE.

CURRENT NOTES ON ANTHROPOLOGY. — V.

[*Edited by D. G. Brinton, M.D., LL.D.*]

Criminal Anthropology.

ONE of the most actively cultivated and also one of the most immediately practical branches of anthropology is that which occupies itself with criminals.

It may conveniently be presented as consisting of three departments, one of observation, the second of explanation, and the third of application. The first takes note of the anatomical and physiological peculiarities of criminals, their psychology, the diseases to which they are most liable, their nationality and ancestry, their nutrition, the environment in which they have lived, etc. The second undertakes the more difficult task of explaining these peculiarities, relying principally on the laws of heredity, atavism, congenital tendencies, early impressions and pathological sequelæ. The third, basing itself on the inferences thus drawn, aims to suggest such modifications in penal laws, and in the management of reform schools and houses of detention as will minimize the objectionable results indicated.

Anthropologists believe that this is the only method of procedure to deal intelligently with the great and growing problem of criminality. On ascertained facts of this nature, philanthropists and legislators must hereafter base their efforts, if they would attain the best results. To those who would like to pursue the subject, two works may be recommended, both published in Paris last year — Dr. X. Francotte, "L'Anthropologie Criminelle," and Dr. Lombroso, "L'Anthropologie Criminelle et ses Recents Progrès," while Dr. Thomas Wilson of the Smithsonian Institution has recently issued an excellent review and summary of the subject.

The Origin of the Alphabet.

We may well excuse Plato for crediting the legend that the letters of the alphabet were disclosed to man by the gods themselves. Certain it is that down till to-day we have reached no positive data as to their origin. It appears that the old notion that the Phœnicians discovered them must be abandoned. Dr. Eduard Glaser, whose long and arduous researches into the epigraphy of Southern Arabia promise to throw an unexpected light on a large tract of ancient history, expresses himself (in *Das Ausland*, December, 1891) quite positively that it is in Arabia we must search for the beginnings of this marvellous invention, and probably in Southern Arabia. There, perhaps nearly three thousand years B.C., the ancestors of the Minæans and Sabeans appear to have developed several related phonetic alphabets, from some one of which the so-called Phœnician was descended. Dr. Glaser has obtained copies of some of these as yet undeciphered inscriptions, probably more than four thousand years old.

What seems sure is, that though the early Egyptian hieroglyphic writing may have suggested the alphabet, the Egyptians themselves never developed it. What is more remarkable, and it seems to me has not received sufficient attention, is the gradual degeneration of the early Egyptian phonetic hieroglyphic system into one mainly ideographic and symbolic in the late demotic writing. The signs in the latter have often no more relation to sound than have the symbols of Chinese script. Thus, three points between two vertical lines, | . . . |, means, in the demotic, "man;" but it was in no way understood to represent the sounds which were in the word, *roemt*, man, in the spoken dialect.

This degeneracy gradually arose from changes in the phonology of the tongue, while the hieroglyphic signs were continued unchanged. It is of course nothing new to Egyptologists; but to the ethnographer and the historian of the arts it is a noteworthy instance of retrogression in one of the most useful and highly prized inventions ever made by man, and that in a country of continuous and unbroken culture.

The Native Written Language of Easter Island.

In the last published report of the United States National Museum, Washington, is a very interesting description of a visit to Easter Island in 1886 by Paymaster W. J. Thomson of the ship Mohican, U.S.N. He describes the platforms, stone images, arts, and language of the natives, aiding the reader by numerous photogravures. In these points his report is full, but not especially new. Where he does go ahead of all previous voyagers is in his information about the remarkable written language which it has long been known the natives of this island had invented, and in which they were accustomed to record their legends. The inscriptions were usually upon slabs or paddles of toromiro wood, a tree indigenous to the island. The figures are of equal height and extend in regular lines along the sides and edges of the piece of wood.

With great difficulty, and finally only by recalling the ancient adage, *in vino veritas*, did Mr. Thomson succeed in persuading an old islander to read some of the inscriptions. He is able, therefore, to show us five of them, the originals in photogravure, with translations into the native tongue of the islanders, and this text rendered into English. It is a most praiseworthy piece of ethnographic study, and should put an end to the nonsense which has long periodically appeared about this island and its inhabitants.

The figures are shown to be "pictorial symbols, carrying their signification in the image they represent." Many objects are treated conventionally, and all are depicted about the same size, thus imparting the aspect of linear uniformity. The subjects treated are family histories, traditions, and lists of the gods, the figures merely serving as pictorial reminders of the names and facts.

In all these respects the inscriptions are in no wise different and not a whit superior to those found on the "meday sticks" of the Algonquin Indians. Neither indicates a high degree of culture, and the line of their evolution is clear enough. As we might expect, the full vocabulary printed by Mr. Thomson shows the natives of the island to speak a well-marked Polynesian dialect, and they seem to have differed from the other Pelynesians in nothing but a somewhat higher developed taste for graphic and glyptic design.

The Thegiha and Klamath Languages.

Two publications have recently been issued by the Bureau of Ethnology, Washington, which should attract the attention of students of the American aborigines. Both are in the series called "Contributions to North American Ethnology."

One is entitled "The Thegiha Language," by James Owen Dorsey. The Thegiha is a member of the Siouan or Dakota stock, and is spoken by the Ponkas and Omahas. The portly volume of 794 quarto pages is filled with a large number of myths, stories, and letters in the language, accompanied by interlinear and free translations, grammatic notes and explanations. A second volume is promised containing a detailed grammar and dictionary.

The work on the Klamath language, which is nearly the same as the Modoc, is by A. S. Gatschet. It is in two quarto volumes of 711 pages each. The first contains an ethnographic sketch of the tribe especially interesting for its mythology, 200 pages of text and 500 pages of grammar; the second volume is the dictionary. The Klamath is described as a synthetic language, inclining to polysyntheticism in the inflection of nouns and the derivation of verbs. Its tendency to incorporation is well marked.

Both these laborious works are exceedingly well done, and reflect great credit on their authors. One must regret, however, that different phonetic alphabets have been adopted. Dorsey employs that of the Bureau of Ethnology, Gatschet that which he calls "my scientific alphabet, based on the original pronunciation of the letters;" not always very scientific, as may be judged from the fact that he gives as identical the *u* sound in English *nude*, German *uhr*, French *cour*. Mr. Gatschet must have learned his English where they call dukes "dooks."

THE GROWTH OF CHILDREN.

In his recent paper on the growth of children in the Twenty-Second Annual Report of the State Board of Health of Massachusetts, page 479 ff, Dr. H. P. Bowditch has called attention to the fact that the curves representing the distribution of cases in those years during which growth continues is asymmetrical, so that the average and median values, (the one corresponding to the point above and below which one-half the total number of cases are found) do not coincide. An examination of the original tables on which this statement is based (The Growth of Children, Eighth Annual Report of the State Board of Health of Massachusetts, 1877, Table 4 ff.), brings out the asymmetry of the curves represented by these figures very clearly, and proves that the difference between the average and median values is not accidental. Dr. Bowditch calls also attention to the fact that the variability of the series first increases and later on decreases.

The causes of these phenomena will be considered in the following lines. When considering statures and weights of adults of a certain region, we find them generally arranged symmetrically around the average which has the maximum frequency. The tables showing the values of these measurements from year to year prove that growth is irregular, being more rapid in the beginning and becoming slower as the adult stage is nearly reached. When we consider children of a certain age, we may say that they will not all be in the same state of development. Some will have reached a point just corresponding to their age, while others will be a little backward, and others still a little in advance of their age. Consequently the values of their measurements will not exactly correspond to those of their age. We may assume that the difference between their stage of development and that belonging to their exact age is due to accidental causes, so that just as many will be less developed as farther developed than the average child of a particular age. Or: there will be as many children on a stage of development corresponding to that of their age plus a certain length of time as corresponding to that of their age minus a certain length of time.

The number of children who have a certain amount of deviation may be assumed to be arranged in a probability curve, so that the average of all the children will be exactly on the stage of development belonging to their age.

At a period when the rate of growth is decreasing rapidly, those children whose growth is retarded will be farther remote from the value belonging to their age than those whose growth is accelerated. As the numbers above and below the average are equal, those with retarded growth will have a greater influence upon the average than those whose growth is accelerated, therefore the average value of the measurement of all the children of a certain age will be too low when the rate of growth is decreasing, and too high when it is increasing.

These considerations may be expressed in mathematical form as follows: —

In the adult, the relative frequency of the deviation x from the average value of the measurement, s, may be expressed by the formula —

$$p_{s+x} = \frac{1}{\mu_1 \sqrt{2\pi}} e^{-\frac{x^2}{2\mu_1^2}}$$

μ_1 is the measure of variability of the series and is called the mean variation, or the mean variability. A series is the more variable the larger μ_1.

The value of the measurement belonging to the average of all those individuals who will finally reach the value s is, at any given period, a function of this period and may be called st. The average of all those individuals who will finally reach the stature $s + x$ may be expressed as a function of st and x, $f({}^st\ ; x)$.

The individuals constituting the adult series will not develop quite regularly, but some will be in advance of others. We assume that at any given time these variations in period will be distributed according to the law of probabilities. The relative frequency of the variation y from the period under consideration, t, will be

$$p_{t+y} = \frac{1}{\mu_2 \sqrt{2\pi}} e^{-\frac{y^2}{2\mu_2^2}}$$

The value of the measurement belonging to a child which will finally reach the value $s + x$, at the period $t + y$, will be $f({}^st + y; x)$. p_{t+y} expresses therefore also the relative frequency of the individuals measuring $f({}^st + y; x)$ at the period t among that class which will finally reach the value $s + x$. The relative frequency of the latter among all individuals is p_{s+x}. Therefore, the relative frequency of the value $f({}^st + y; x)$ among the whole series will be

$$P_{f({}^st + y;\, x)} = p_{s+x}\, p_{t+y} = \frac{1}{\mu\,\mu_1\, 2\pi} e^{-\frac{x^2}{2\mu_1^2} - \frac{y^2}{2\mu_2^2}}$$

It remains to determine $f({}^st + y\ ; x)$. The function $f({}^st\ ; x)$ may be obtained by observations on the same individuals taken in annual intervals. The form of the function will be

$$\left.\begin{array}{l} f({}^st\ ; x) = {}^st + f_1({}^st)\,x + f_2({}^st)\,x^2 + \ldots \\ \text{and} \\ f({}^st + y; x) = {}^st + y + f_1({}^st + y)\,x + f_2({}^st + y)\,x^2 + \ldots \end{array}\right\} x_0 < x < x_1$$

By means of observations we find also

$$\left.\begin{array}{l} {}^st + y = {}^st + a_1 y + a_2 y^2 + \ldots. \\ f_n({}^st + y) = \overset{(n)}{b_0} + \overset{(n)}{b_1} y + \overset{(n)}{b_2} y^2 + \ldots \end{array}\right\} y_0 < y < y_1$$

By substitution we find

$$\left.\begin{array}{l} f({}^st + y; x) = {}^st + a_1 y + a_2 y^2 + \ldots. \\ \qquad + x\,(b_0' + b_1' y + b_2' y^2 + \ldots) \\ \qquad + x^2\,(b_0'' + b_1'' y + b_2'' y^2 + \ldots) \end{array}\right\} \begin{array}{l} x_0 < x < x_1 \\ y_0 < y < y_1 \end{array}$$

For a certain series of combinations of x and y this function will remain constant. Then the function may be considered a new variable u —

$$f({}^st + y;\, x) = {}^st + u.$$

The probability of finding the value ${}^st + u$ is

$$T_{{}^st + u} = \int_{-lim}^{+lim}\!\!\int P_{f({}^st + y;\, x)}\, dy\, dx + R$$

where the limits depend upon x_0, x_1, y_0, and y_1, and where R is a certain rest which is determined by the same values.

By assuming the limits x_0, x_1, y_0, y_1 sufficiently narrow and neglecting terms of higher degrees, which may be done on account of the smallness of their factors, the equation assumes the form

$$T_{{}^st + u} = \frac{(1 + c\,u)}{M\sqrt{2\pi}} e^{-\frac{u^2}{2M^2}}$$

$$M = \sqrt{a_1^2 \mu_2^2 + b_0^2 \mu_1^2}$$

This function is asymmetrical. It is, therefore, shown that the asymmetry of the curves is an effect of the irregularity of growth.

Only for $a_2, a_3, \ldots = 0$

and $\overset{(n)}{b_1}, \overset{(n)}{b_2} \ldots. = 0$, the curve will be an ordinary probability curve, c being zero in that case. When a_2, a_3, ... are zero, growth is regular.

We may also draw certain conclusions in regard to the value M. μ_2 is the variability of period. According to the laws of probability this variability must be proportional to the square-root of time elapsed —

$$\mu_2 = \mu \sqrt{t}.$$

It is also probable that

$$f({}^st\ ; x) = {}^st + x \sqrt{\frac{{}^st}{s}}$$

$$b_0 = \sqrt{\frac{{}^st}{s}}$$

$$M^2 = a_1^2 \mu^2 t + \frac{{}^st}{t} \mu_1^2$$

We will investigate for which points

$$M > \mu_1,$$

$$a_1^2 \mu^2 t + \frac{{}^st}{s} \mu_1^2 > \mu_1^2$$

$$a_1^2 \mu^2 t > \frac{s - {}^st}{s} \mu_1^2$$

For small values of t, $\frac{s - {}^st}{s}$ is large, but at a certain period, when a_1 is still large the product on the left-hand side will rapidly increase over that on the right-hand side until a_1 begins to decrease. It may be expected that in all cases when a_1 is sufficiently large, i.e., the growth rapid, there must be a time when the variability of the growing series is greater than that of the adult series.

M and μ_1 are known by observation. Therefore μ_2 may be computed according to the formula

$$M^2 = a_1^2 \mu_2^2 + b_0^2 \mu_1^2,$$

and we have, therefore, a means of determining the variability of period of the growing individuals. By means of this value we can also determine how many individuals of any given age will have reached the adult stage.

This theory holds good for statistics of all kinds of development, whatever the cause of the development may be: for physical measurements as well as for psychical; for growth as well as for the effects of practice. FRANZ BOAS.

Clark University, Worcester, Mass., April 25.

G. P. PUTNAM'S SONS will publish immediately "New Chapters in Greek History," based upon the latest archæological discoveries, by Professor Percy Gardner of Oxford, and "The Test Pronouncer," by W. H. P. Phyfe, a companion to the author's "7,000 Words Often Mispronounced," containing the same list of words, differently arranged, for convenience in recitations. They also announce new supplies of Phyfe's books on pronunciation: "7,000 Words Often Mispronounced," "How Should I Pronounce," and "The School Pronouncer."

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AN INSTRUMENT FOR MAPPING HOT AND COLD SPOTS ON THE SKIN.

Preliminary Note.

VARIOUS defects and inconveniences in the apparatus employed by Blix, Goldscheider and Donaldson led to the determination to produce an instrument that would present a metal point of any desired temperature at any point of the skin. The temperature must be accurately known and must not vary. A registering apparatus was also to be provided, and the old system of testing till a spot was found and then marking it with ink was to be done away with.

In the present instrument the hot or cold stimulus is applied by water running through a small copper box that comes to a point at one end. The constant stream of water keeps the point at the temperature desired, and a thermometer projecting from the top of the box indicates this temperature. To prevent sudden changes resulting from the application to the skin, the sides of the box are rather thick, thus providing a mass of copper of great conductivity; a change of temperature at any one point is at once compensated by conduction without any measurable effect on that of the whole box.

To apply this box to the skin, an arm has been constructed which can be placed in any position and which by means of rack and pinion gives a motion to the box in the three planes of space. The arm is supported by a ball-joint so arranged that it can be clamped anywhere to a table or a chair in a manner that will bring the point of the litttle box near the skin-surface to be examined. Finer adjustments are made by the screws of the rack and pinion. The point is now applied to the skin, and is moved forward by one of the screws for a short distance, e.g., one centimeter, the person noticing the temperature spots as the point passes over them. Then the point is moved sideways one millimeter, and drawn back again. In this way the whole surface can be gone over with the greatest accuracy.

On the part of the arm moving with the point is a small electro-magnet carrying a pencil which descends when the circuit is completed. On the part that does not move with the point is a litttle flat plate, on which a piece of millimeter paper is fastened. The circuit is closed by a key in the hand of the person experimented upon whenever he feels a hot spot or a cold spot, as the case may be. Since the pencil executes the same motion as the point the result is an accurate map of the spots directly on the millimeter paper,

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SOME USES OF BACTERIA.[1]

EVERY farmer, of course, appreciates the value of keeping stock, and you all know that you cannot run a farm without your cows, your horses, your sheep, your hens, and your pigs. You do not appreciate, however, that it is just as necessary to keep a stock of bacteria on hand, on your farm, to carry on your farming operations. The farmer has learned to-day that he must keep a good breed of cows and a good breed of stock in general, but farmers generally do not appreciate that it is equally necessary to keep a good breed of bacteria. You cannot make butter or cheese without cows; you cannot make butter or cheese satisfactorily without bacteria. You cannot cultivate your fields without your horses to help you, but all the cultivation that you might give your fields would be useless were it not that these little creatures of which I shall speak this morning come in after you get through and complete the process which you have begun.

Now, probably many of you have never particularly thought that your farm is stocked with bacteria, but they are there. They are in your brooks, in your springs, in your wells, in your rivers; they are in your dairy, in your milk, in your butter, in your cheese, in your barn. They are in the air, they are in the soil, and your manure heap is a paradise for them.

Bacteria are in rather bad odor in the minds of most people, and we are all inclined to look with horror upon them. We have a sort of shrinking when any one speaks to us of the number of bacteria in the milk which we drink. The reason for this, however, is simply an historical one. When bacteria were first discovered it was early noticed that they had a causal relation to disease, and scientists went to work from the very first to investigate diseases in relation to bacteria. The result was that after a few years a great deal of information had accumulated showing that bacteria caused diseases. The so-called "epidemics" are usually the result of bacteria, and with minds intent upon this side of the question scientists did not pay much attention to the good that bacteria might do in the world. It was more interesting to study disease. People are very much interested when you begin to tell them why it is that they have small-pox, why it is that they have yellow-fever; the other side of the matter, however, is not so interesting.

But the fact is that the bacteria story has only been half told, and thus far it is the smaller half that has been told, if there is such a thing as the smaller half. It is true that bacteria are occasionally injurious to us, but it is equally true that they are of direct benefit to us. Hitherto we have looked upon bacteria as belonging to the medical profession; we think the doctors ought to know about them because they produce disease, but ordinary people do not need to bother themselves with these things. But I think, before I get through with my talk this morning, you will see that bacteria have a very much closer relation to you as farmers than they do to the doctors. It is the farmer to-day who ought to understand bacteriology. It is well enough for the medical man to understand the subject also, but bacteriology has already become a medical subject, while the agriculturist has generally neglected it.

I propose in my talk this morning to point out to you a few of the benefits which you as farmers derive from the agency of these microscopic organisms. I shall divide the subject into four

[1] An address by Dr. H. W. Conn, Wesleyan University, Middletown, Conn.

heads. First, *miscellaneous:* At the very outset I am going to say a word or two in regard to yeasts. Now, yeasts are not bacteria, but they are microscopic plants closely related to bacteria, and their agency in nature is very similar to that of bacteria in some respects; so I shall say a word or two in regard to them.

What is the function of yeasts? Yeasts are plants which have the power of growing in sugar solutions, and while growing there they break the sugar to pieces and produce from it two compounds; one of them is alcohol, and the other one is the gas which we commonly call carbonic acid (CO_2). We make use of yeasts for various purposes along two directions. We may use them either for the purpose of getting the alcohol or for the purpose of getting the carbonic acid. For instance, you want to bake a loaf of bread; you take your dough, you plant yeast in it and set it in a warm place; now, there is always a little sugar in the dough, and the yeast begins to grow, breaking the sugar to pieces as I have just stated, and producing from it alcohol and carbonic acid. The carbonic acid is a gas, and as the yeast grows and the carbonic acid makes its appearance in the bread, little bubbles are seen in the dough until presently it becomes filled with these little bubbles of carbonic acid gas which render it lighter. Of course, as the gas accumulates the dough swells, or, as we say, it "rises." Then you bake it, and when you take it out of the oven and cut it open you find that the bread is full of little holes. Those little holes are the remains of the bubbles of carbonic acid gas which the yeasts produced, and the object of growing the yeast was simply to make those holes in the bread. The bread is light, and the object of the introduction of the yeast is thus accomplished. You cannot bake a loaf of bread, then, without the agency of microscopic organisms.

In the baking of bread we have an instance of the use of carbonic acid alone. In the manufacture of wine the object of the vintner is to get the other product of yeasts, namely, the alcohol. He grows yeasts in his grape juice, usually depending upon those from the air. Again there is carbonic acid and alcohol produced and the carbonic acid in this case passes off into the air during the fermentation, while the alcohol remains behind; when the fermentation has continued long enough a considerable amount of alcohol remains in the grape juice, and thus produces the wine. Similarly in the manufacture of alcohol or of any of the other alcoholic liquors, such as rum or whisky, the same process is made use of; that is, the little yeasts are planted in some sort of sugar solution, it may be molasses, it may be barley; they grow there; there they produce carbonic acid and alcohol; the carbonic acid is allowed to go off into the air, and the alcohol remains behind. Then by the processes of distillation the alcohol is separated from the fermenting mass. The carbonic acid is all given off into the air in these cases.

In the manufacture of beer the attempt is made to get both products of the yeast growth. In the making of beer the yeast is cultivated in the same way in the malt; alcohol and carbonic acid both are produced. After some fermentation the beer is put into bottles. A certain amount of fermentation takes place after the bottling. The carbonic acid thus produced is dissolved in the liquid and soon accumulates so as to produce considerable pressure. When the bottle is opened it is this gas which causes the froth at the top of the beer. It is the alcohol which produces the intoxicating quality in the beer, but it is the carbonic acid chiefly which gives the beer its sharp, pungent taste. The alcohol aids, of course, to a certain extent, but the carbonic acid is the chief factor in the taste of beer. It may be a little question whether it is proper to use yeasts in this way, to produce rum, whisky, alcohol and beer, with the untold miseries which they involve; nevertheless, yeasts are at the foundation of the gigantic industries connected with distilling and brewing operations.

The farmer makes use of them in the manufacture of cider. Yeast from the atmosphere is planted in his apple juice; it attacks the sugar that it finds there, breaks the sugar to pieces, and produces carbonic acid and alcohol as before. The carbonic acid accumulates during the first day or two, and gives the sharp, pungent taste that is noticeable in sweet cider. Later on the alcohol accumulates in larger quantities, and that gives the taste to hard, sour cider. After the cider has fermented for several days the carbonic acid is of second importance; the alcohol accumulates until you get the strong, sharp, intoxicating hard cider. So much, then, for the uses to which we put yeasts.

Now, leaving yeasts, turn for a moment to the consideration of a few miscellaneous phenomena connected with bacteria. I may take as a starting point this very product that I mentioned last, namely, hard cider. Your yeasts produce alcohol in your cider. You let your cider stand in a barrel for several months, and little by little a change takes place in it; little by little the oxygen is taken out of the air and handed over to the alcohol, and when the alcohol gets hold of the oxygen it is no longer alcohol; it becomes acetic acid, and your cider is changed into vinegar. Now, it has been determined that it is through the agency of bacteria that the alcohol succeeds in getting hold of the oxygen. Bacteria grow on the surface of hard cider, forming a sort of scum, producing indeed, what we call "mother of vinegar." These bacteria growing on the surface in some way take oxygen out of the air, pass it down into the fluid, give it to the alcohol, and when the alcohol gets hold of it, it becomes acetic acid, and you get vinegar where you originally had cider. The manufacture of vinegar, then, is a process dependent upon the growth of bacteria.

The manufacture of lactic acid is a process somewhat of the same character. Lactic acid is not a commercial article of very great importance, but still there are some factories in this country that manufacture it and put it upon the market to be sold for certain purposes. In the making of lactic acid the manufacturer makes constant use of bacteria. By the cultivation of bacteria in milk the milk sugar is changed into lactic acid, which the manufacturer separates from the milk and puts upon the market. So you see that the manufacturer of lactic acid is wholly dependent upon bacteria; he could never produce it without their aid.

Perhaps, under this head of "Miscellaneous," I may just refer to a matter which is of considerable practical importance, and that is the matter of ensilage. We do not know very much about the theory in regard to the management of a silo at the present time, but we do know that the whole process of procuring proper and sweet ensilage is a process of properly managing bacteria growth. If you manage the bacteria growth correctly your ensilage will remain sweet and will become a food which is very desirable for your cattle; but if you do not manage the bacteria growth correctly your ensilage will decay, it will become sour, undergo fermentations, and you will suffer from it. It is, then, to bacteria that the farmer owes his new process of obtaining food through a silo.

I will pass now to the consideration of the second topic, and that is, the relation of bacteria to dairy matters. I have already once or twice before in your meetings brought up this question of the relation of bacteria to the dairy. At the meeting a year ago some of you may remember that we considered the subject of the fermentations of milk, when we saw that all of these fermentations, most of which are very undesirable, are connected with the growth of micro-organisms. Now, so far as milk is concerned, bacteria are pretty much of a nuisance. The milkman does not want them; they produce the souring of his milk; they make his milk bitter or slimy; sometimes they make it blue, and they produce all sorts of abnormal fermentations which a milkman does not want. But I am not to consider that side of the question this morning, and I will pass the subject of milk and turn for a moment to a consideration of the relation of bacteria to butter-making and cheese-making.

Every butter-maker is acquainted with the fact that in the normal process of making butter, the cream is collected from the milk and then is allowed to ripen. It is put in some sort of vessel and allowed to stand in a warm place for a day or so, and during that time immense changes are taking place in it. At the end of the time the cream has become slightly soured, it has acquired a rather peculiar, pleasant, indescribable odor, and it has reached the proper condition for churning. During that time, our microscope tells us that bacteria have been multiplying with absolutely inconceivable rapidity. They multiply so that they increase during a day, perhaps, five to six thousand-fold. Each bacterium with which you start when you begin to ripen your cream, produces at least six thousand by the end of twenty-four hours, and usually they will produce a much larger number than that. So that bacteria are growing in this ripening cream with absolutely incredible rapidity. Now, you butter-makers know that you gain some advantage from ripening the cream, or, at least, you think you do. You think your butter churns a little easier and that you get a little more butter from a given quantity of cream if you ripen it, and, above all (and this, perhaps, may be regarded as the chief value of ripening), the butter acquires that peculiar, delicate, pleasant aroma which is essential to a first-class quality of butter, that peculiar aroma which is not acquired if you do not properly ripen your cream before churning it.

Now, the explanation of the production of that aroma is simply this: These bacteria are agents of decomposition. Bacteria, as they grow in any solution, tend to decompose it or pull it to pieces. If they grow in an egg, they decompose the egg and cause it to putrefy and decay, and when they begin to grow in your cream they begin the same process of decomposition. If you should let your cream ripen for a week or two, you would very readily see that the process of decomposition had taken place, and your cream would become very offensive. The moment you begin to ripen your cream, the bacteria begin to decompose it. Now, as the result of decomposition, a great many chemical products are produced, and they have all sorts of smells and tastes. If you should let decomposition go far enough, you would get the bad odor of decay, but you do not get that odor when decomposition begins. The first of the decomposition products are rather pleasant in odor, and pleasant in taste, and if you churn your cream at that stage of decomposition, your butter is flavored with the early decomposition products. This flavor is the aroma of good butter, this is what fancy butter-makers sell in the market and get a high price for. They get a high price, then, for the decomposition products of bacteria, for a proper tasting butter brings a higher price than that which does not have this aroma, and the aroma is the gift of bacteria. You may ask, What becomes of the bacteria? It really makes little difference what becomes of them. Some go into the buttermilk, some go off in water used in washing, some go into the butter and the salt kills them. It is no matter where they go. After the butter is churned they are no longer of any importance to you or any one else; their career, so far as the dairy is concerned, is ended.

If the butter-maker owes something to bacteria, the cheese-maker owes everything to them. The butter-maker cannot get the proper aroma without the agency of bacteria, but the cheese-maker cannot get anything. Of course you all know that fresh cheese is very inane and tasteless. Nobody likes fresh cheese. It has a sort of curdy taste and is quite unpalatable. You know, however, that after cheese is made, it is set aside for a number of weeks to ripen. It may ripen several weeks, or, perhaps, months. Sometimes in the case of the best cheeses, it may be ripened a year or more. Now, during that ripening process, exactly the same changes are taking place that I have mentioned in cream. The bacteria are growing, are attacking the casein, and pulling it to pieces. They produce many changes in it, and cause an accumulation of all sorts of materials which have peculiar tastes, and little by little the cheese is ripened. After a while the cheese begins to have a pleasant taste and then a strong taste, and if you leave it long enough, you get a very strong cheese. The longer you ripen a cheese, the stronger its taste becomes. An old cheese is always a strong cheese, a fresh cheese is always a mild cheese. The shorter the time you cultivate bacteria in it, of course the slighter will be the changes which they produce; the longer you cultivate the bacteria, the stronger becomes the cheese.

Now, in the ripening of cheese, we find the cheese manufacturer's greatest difficulty. Every cheese manufacturer knows that, under conditions which seem to be exactly alike, he may get good cheese and he may get bad cheese. His cheese may become tainted, it may become spotted with little red spots or some other abnormal conditions may appear which he cannot account for. It would be the greatest boon possible to the cheese-maker if we could, in some way, enable him to correct his abnormal ripening processes, and be able always positively to insure the proper sort of ripening. Now, this is plainly a matter which is connected with the planting of the proper kind of bacteria in a cheese and planting them under proper conditions. Different kinds of cheeses are on our markets. We have the Edam cheese, we have the pineapple cheese, we have the Neufchatel cheese, we have the Limburger cheese, and many other kinds. Of course, we all know that these different cheeses have very different flavors. Now, in the production of these different kinds of cheeses, there are different methods used. For instance, in the manufacture of Edam cheese, the cheese-maker puts a little slimy milk into the milk that he is going to make into his cheese. That slimy milk contains a certain species of bacteria, and that peculiar species connected with that slimy milk produces the peculiar flavor which we get in the Edam cheese. Sometimes cheese is allowed to ripen soft for a few days before it is pressed, and when thus ripened, different kinds of bacteria grow in it, and grow in it more rapidly and produce different odors. Experiments have just been begun along this direction which show that it is possible artificially to ripen cheese abnormally. You can take certain species of bacteria and grow them in cheese, and you get a very atrociously tasting cheese, and you can take others and get a very good cheese. Now, in the use of yeasts, we have learned to plant yeast in our bread; we have learned to plant yeasts in our material that we want to ferment, if we are going to make alcohol, or, if we are going to make beer. The brewer has learned that he must use an artificially prepared yeast. He has learned that if he simply allows the malt to ferment naturally through the agency of atmosphere yeasts, he does not know what he will get. It will ferment, undoubtedly, but it will be likely to ferment in an abnormal manner. He, therefore, plants a pure culture of the proper yeasts. But we have not yet learned to plant bacteria in the same way. The cheese-maker has not yet learned to cultivate bacteria as the brewer has learned to cultivate his yeasts. Some day, I think we may say in the not far distant future, after our Experiment Stations have had time to work upon this matter a little longer, the cheese-maker is going to be told of some way in which he can cultivate bacteria as the brewer does his yeast, and then he will know what kinds of bacteria will produce a badly-ripened cheese, and what kinds will produce an exceedingly good cheese. The time is coming, it has not come yet, but when it does come, we can see that there will be a tremendous development of the cheese industry in this country.

We know there are four or five hundred species of bacteria in the world. They all produce different sorts of decomposition, they all produce different odors and different flavors, and when our scientific stations have taught our cheese-makers to cultivate their bacteria and plant particular kinds of bacteria in the milk of which they are going to make cheese, perhaps we are going to have four or five hundred different kinds of cheese. For aught we can see, it may be that the various species of bacteria will produce different flavored cheeses, and perhaps fifty years from now, perhaps in less time, a man may go to the store and order a particular kind of cheese that was made by a peculiar kind of bacteria, and another one made by another kind. We cannot tell what possible development there may be of the cheese industry in the future, and whereas now the cheese-maker must depend very largely upon accident for the particular kind of flavor he is going to get in his product, then he will be able to tell absolutely what he must use in order to be able to produce the flavor that he wants. The result will be a great development of the cheese industry, if such time ever comes.

There will be another advantage in this development when it comes. We all know that once in a while cheese becomes poison. Everyone has read in the newspapers accounts of people who have been poisoned by eating cheese. Under certain conditions, cheese is very distinctly poisonous, and has produced very many cases of sickness and many cases of death. Now, our chemists have studied this poisonous cheese. They have found that it is poisonous because of the production of a peculiar chemical substance in it which they have called "tyrotoxicon." They have found, further, that this tyrotoxicon is a poison produced by a certain species of bacteria. Once in a while that poisonous kind of bacteria gets into milk. The cheese manufacturer is entirely innocent; he cannot help it, because he has no means of knowing anything about it. But occasionally they get in and his cheese is ripened then under the agency of these injurious bacteria. The result is, that his cheese becomes poisonous, and while he is perfectly innocent of any intentional wrong, the evil is done. Now, when our cheese-makers have learned to apply to the manufacture of cheese the processes which our brewers have learned in the manufacture of beer, these troubles can be prevented Twenty years ago, a Frenchman, Pasteur, undertook to make an investigation of the diseases of beer, and he found that they could be prevented by the use of a few simple remedies which prevented the growth of the wrong kinds of yeasts or the wrong kinds of bacteria in it. His methods were soon applied to the whole brewery industry in France, and also to the manufacture of wine, and the result has been that those diseases which used to be so common and so troublesome to the vintners and the brewers have practically disappeared. So, then, when we in the future learn to apply similar methods in the manufacture of cheese, we may hope for the disappearance of all diseases of cheese, including the red specks in cheese, tainted cheeses of all sorts, and also the disease which makes cheese poisonous, as just mentioned.

You see, then, that to the dairy interests bacteria are of distinct value. They give the aroma to your butter, and they give the whole flavor to your cheese, or at least, the chief flavor. Without them your butter would not command so good a price in the market; without them your cheese would not command any price.

I may now pass to the third branch of my subject and speak of the use of bacteria as scavengers in the world. A tree in the forest falls to the ground and it lies unmolested. It is at first hard, solid, and impervious to all of the normal agencies. No insects can touch it; they cannot bite the hard wood to any extent. It lies there month after month. Little by little it begins to soften.

First the bark begins to get soft and finally falls off. By-and-by the wood gets quite soft, so that you can easily cut it, and perhaps run a pointed stick into it. Then insects can get hold of it, and they begin to eat it; they bore tunnels and begin to crawl through it. The tree grows softer and softer, and finally, as you all know from observation many times, the trunk of this tree becomes softened into a mass of brown powder which sinks down into the soil and disappears. What has become of that tree? A bird dies and falls on to the ground, and unless some animal comes along to eat the bird, you will notice that the tissues of the bird very soon begin to undergo changes; they begin to soften; gases rise from them; the flesh of the bird undergoes the process which we call putrefaction, and that putrefaction results in the gradual decomposition of the tissues. Little by little part of the material passes off into the air as gas, and the rest of it sinks down into the soil, and the bird disappears. What has produced all of these changes? Did it ever occur to you to ask what the condition of the surface of the earth would be at the present time if it were not for these processes which we call the processes of decay? Suppose there were no agencies which caused the gradual softening and destruction of trees and the dead bodies of animals. Long since the vegetable and animal life of this world would have disappeared, and we should have had the surface of the earth covered with the accumulations of the growth of forests in past ages that would have tumbled upon each other until there would be such an accumulation of dead trees and dead leaves and dead vegetation of all kinds on the surface of the earth, that plants would not be able to grow. The dead bodies of all the animals that have lived in the past would have been piled up until the whole surface of the world would have been so covered by the dead bodies of animals and plants that life would have become impossible. These scavengers, these bacteria, are absolutely necessary to us. It is through the agency of certain bacterial organisms that the tree is softened so that insects can get at it. It is through the agency of bacteria that the tissues of the bird are decomposed and gases produced which pass off into the air. It is these bacteria which cause all the changes in the bodies of animals and vegetables, decomposing them until they gradually sink down into the soil and disappear. So it is through their agency and this alone, that the surface of the earth is kept in a condition which renders it possible for life to continue to exist. Of course you have all had experience of the value of bacteria as scavengers in removing bad odors. We speak of scavengers as of value in removing decaying material, but it is the bacteria which produce the decay, and it is through their agency that all of these dead bodies are broken to pieces and brought into a condition in which they can be either incorporated into the soil, or passed off into the air.

Perhaps I may here also say a word in regard to the agency of bacteria as scavengers in the human body. We look upon bacteria in our bodies as causes of disease rather than things which are of any value, and yet a healthy person always has bacteria in large quantities in his mouth, in his stomach. and in his intestines. The bacteria are always migrating in the body to places of abnormal growths, and there is considerable reason for thinking that to a certain extent these bacteria act as scavengers in the human body. Some of them unquestionably act as producers of disease, but, to a certain extent, it seems that these bacteria are of value in assisting in the decomposition of tissues that should be decomposed, and there is reason for thinking that they assist in the digestion of food. There is no question that bacteria may assist in the process of digestion and it is doubtless a fact that the bacteria which we take into our alimentary canal are not wholly injurious. They may be possibly beneficial to us either in the line of scavengers in removing material which ought not to remain in our bodies, or in assisting digestion. This point, however, is not yet demonstrated, and I merely allude to it as a possibility.

This may lead us to the fourth topic of my lecture, which I may call the Agency of Bacteria in Plant Life.

Did it ever occur to you to ask why nature is perpetual? You know animals and plants have continued to live on the surface of the earth for hundreds and hundreds of centuries. The vegetation that has been growing on the surface of the earth has been constantly taking food out of the air and taking food out of the soil, and animals have been constantly feeding upon the plants. But the process seems to be a never-ending one. It would seem that the material for plant food and animal food would sometime be used up; and yet nature is perpetual. Now, the reason that nature is perpetual is, because animals and plants are enabled, by certain processes of nature, to use the same material over and over and over again. They can use material for food, and eventually that same material gets in a condition in which they can use it for food once more. Let me take a single illustration, one that you are probably all familiar with. Plants, as the result of their life, use up carbonic acid of the air, and, in return, send off into the air an equivalent amount of oxygen. Now, animals in their life, take out of the air a considerable amount of oxygen and send off from their bodies an equivalent amount of carbonic acid. You see here one of the adjustments of nature. Animals use the excretions of plants, plants use the excretions of animals. The animals take oxygen and give off carbonic acid, and the plants take carbonic acid and give off oxygen. The process goes on continually, and thus the condition of the atmosphere, so far as oxygen and carbonic acid are concerned, is kept in the same normal state. Thus, so far as these gases are concerned, nature is enabled to be perpetual by the constant use of the same material over and over again.

Now, this is not only true in regard to oxygen and carbonic acid, but it is true also that all the other foods of animals and plants are capable of being used over and over again. Plants live upon phosphates, sulphates, and nitrates chiefly, as well as carbonic acid. Animals live upon such things as albuminoids and starches and sugars. Now, plants cannot live on the food of animals, and animals cannot live on the food of plants. You and I cannot live upon sulphates and phosphates and potassium salts and nitrates and carbonic acid. These are what we call inorganic compounds in nature. Animals cannot feed upon them, but plants can do so. The plants can take those materials and manufacture out of them the starches and sugars and fats and albuminoids, and then we can take the starches and sugars and fats and albuminoids which have thus been manufactured for us and feed upon them. You see, therefore, that the plants serve as a medium of communication between animals and nature. The world is made up chiefly of inorganic compounds like these phosphates and sulphates and potassium salts, etc., and the plants serve as a means of communication between animals and the inorganic world, for the plants take these inorganic materials and make them into something which we can use as food. Plants, then, are the means which we have of making use of inorganic nature; or, in other words, the whole animal kingdom is parasitic upon plants. But plants are in their turn utterly unable to live upon animal foods. A plant cannot feed upon albumen, a plant cannot eat starch, a plant cannot eat sugar, a plant cannot eat fat; plants are unable to use the foods that animals use, and when the body of a plant dies, although it is in a condition to be used as food by animals, it is not in a condition to be used again as food for plants. The dead body of the bird is in a condition in which plants cannot make use of it at all. A plant cannot use the albumen of the bird's tissue; a plant cannot use the fats in an animal; a plant cannot feed upon the sugars that are in the dead sugar-canes; a plant cannot feed upon the starches or the cellulose that is in the body of the dead tree. Nevertheless, the plants do succeed in getting hold of this food, and it is through the agency of these bacteria that we are speaking of this morning that they do it. Just as soon as the body of an animal or plant dies, the bacteria get into it, begin to grow in it, decomposing it, and pulling it to pieces. They pull the starch to pieces, they pull the sugar to pieces, and albumens and fats share the same destruction. Little by little they take those compounds which plants cannot feed upon, and, by shaking them to pieces, bring them down to simple combinations which plants can feed upon.

Of special importance is one particular kind of organism known as "the nitrifying organism," which produces nitric acid. Plants, as I have said, cannot feed upon such things as albumen. The putrefying bacteria can decompose albumen and break it up into certain simple compounds, but ordinary putrefying bacteria are not able to break that albumen down far enough for plants to get hold of it. Plants have got to live upon such things as nitrates and salts of nitric acid. Now, there is one sort of bacteria living in the soil which gets hold of the albuminous compounds and forms nitric acid. This is the nitrifying organism, and the nitrification is the last stage in the decomposition process by which an albuminoid is converted into a condition in which plants can get hold of it. One practical application of this you are all familiar with in the ripening of fertilizers. You know that green manure is of absolutely or of practically no use as a fertilizer on your fields. You know that it must first stand for a while and ripen, or "rot." as you call it. Now, what is taking place in that fertilizer while it is ripening? Simply the series of changes that have been mentioned. That fertilizer contains chemical compounds of a high degree of complexity, compounds that the plants cannot feed upon; they are too highly complex for plants to use as food. Bacteria, however, get into that heap and begin to grow in it; and, as the fertilizer becomes ripened, these high chemical compounds are pulled to pieces, they become converted into simpler decomposition products, and eventually, if the ripening is continued long enough, the fertilizer is in a condition fit for the fields. Now, when put upon the fields, the plants can get hold of the material. You will see now what I meant when I stated at the beginning of my lecture that in spite of all the cultivating that you and your horses might do in the fields, it would be useless without the agency of these organisms. You might put on your fertilizer; but, if that fertilizer is not acted upon by bacteria, it will be of no use, and thus the bacteria come in to complete the operation which you began. You do your duty and the bacteria do theirs, and the consequence is, the fertilizers which you are using are brought into a condition in which the plants can get hold of them, and thus the food of plants is produced. You see, then, that in this way plants and animals are able to use over and over again the same material. The plant gets this material out of the soil and out of the air; the animal comes along then and feeds upon the plant; then the animal dies, and the plant dies, and the bacteria get into the body of the animal or plant, pull it to pieces and produce from it decomposition products, and they get into the soil in the form of nitrates and nitric acid compounds; or they go off into the air in the form of ammonia and carbonic acid. The bodies of these animals and plants are thus reduced to simple conditions, and now the plants once more get hold of them, and use as food the same material that previous generations used. Thus over and over again the same material is used, and thus nature is kept perpetual. This is the explanation of the constant, perpetual growth in nature. This is the reason that nature does not exhaust itself. This is the reason that animals and plants have been enabled to grow upon the surface of the earth for the past hundreds and hundreds of centuries.

But this is not the end of the agency of bacteria in plant life. They are not only of value in ripening your fertilizers and in keeping up this constant growth of nature, but we have learned within the last two or three years that at the very foundation the growth of plants is absolutely dependent upon these organisms, and similarly in the future the continuance of the vegetable world must be also dependent upon them. I have stated that nature is perpetual because the same material can be used over and over again. That is true in a sense, but not true completely, for you will see with a little thought that little by little the soil is being drained of its food, little by little the materials in the soil are being turned into the ocean. A tree grows, takes out of the soil its food, and finally dies. If it falls on to the ground, as I have described, the bacteria get at it and grow there until the tree eventually becomes wholly incorporated into the soil so that it can be used once more as plant food. But it may be that the tree instead of falling in the forest falls into a river, drifts down the river, begins to decay, and eventually goes into the ocean. After the products of decomposition are passed into the ocean, there is no getting them back to the soil. "The sea will not give up its dead," and the ocean does not give up the nitrogen and the other salts that are gradually being carried to it by this process. Or, again, a plant grows and produces wheat, produces fruit, produces nuts, and the grain, the fruit, and the nuts are taken to the city to be used as food for men. The food is used by men, and most of it eventually gets into the sewage of the city, is carried down to the river, and from the river it is carried into the ocean. So here again through the sewage of our cities the foods which are supplied to our cities are being thrown into the ocean, and thus the soil is being drained of its foods. This process is not a rapid one. It is only slowly that the foods are being taken out of the soil and carried to the ocean. Nevertheless, it is the constant dropping that wears away the rock, and it is easy for us to see that if this process goes on age after age, our soils are inevitably doomed to exhaustion. You know that many fields have become sterile, that many farms have been worn out, that many gardens are becoming infertile. You cannot cultivate your fields as you used to without furnishing them food. In the Old World this is quite noticeable. Although the constant draining of the soil by these agencies is a slow one, it is a sure one, and if there is no way of getting nitrogen and other salts back from the ocean to the soil, it would seem that the life of all vegetation is inevitably doomed to exhaustion, and with the life of vegetation the life of animals must cease, the whole living world must end.

When the scientist observed this fact, he immediately looked around to see if there was not a remedy for it. Now, as far as some of the plant foods are concerned, there does not seem to be any occasion for fear. The phosphates, the sulphates, and the potassium salts, which are plant foods, seem to exist on the surface of the earth in almost unlimited quantities. There have been immense amounts of these salts found in certain parts of the world, and they can be mined at very small expense; they can be taken all over the world and put directly upon the soil, so that the sulphates, phosphates, and potassium salts are in practically unlimited quantities. We have no fear so far as they are concerned. For an indefinite number of ages to come there is plenty of this sort of food on the surface of the earth for us to supply to the soil. But that is not true of the nitrogenous foods. Of course, every farmer knows to-day that nitrogenous food is one of the very essential foods of plants, and it is not true that there is an unlimited quantity of nitrogenous salts anywhere in the world. There are few sources of nitrogen other than the soil. The chief one is the guano beds in the South Pacific. These are sources of nitrogeneous compounds, and upon these sources the agricultural industry of the world has been drawing for years, and will continue to draw until they are exhausted. But these sources are far away. The nitrogen that we get from them is very expensive, and the store is very limited in quantity. We can see in the not very distant future the complete exhaustion of all these nitrogen beds. This has led scientists to look with a considerable degree of dismay upon the future of the vegetable world. What is going to happen when all the available nitrogen is used up? If we are going to continue to take the nitrogen from the soil, and throw it into the ocean, we will soon exhaust the soil, and if there is no store of nitrogen anywhere for our plants to draw upon, what are our plants going to do in the future?

Now, there is a store of nitrogen in the world which is absolutely unlimited, and that is in the air that surrounds us. The air that we breathe is made up of four parts of nitrogen and one part of oxygen. There are quantities of nitrogen everywhere if the plants could only get hold of it, but it has been thought that plants cannot feed on the nitrogen in the air at all. Experiments have been carried on for a great many years to find out whether plants could not in some way or other get hold of the nitrogen of the air. If we could only prove that our plants can get hold of the nitrogen in the air then the problem is solved. But the experiments which have been carried on year after year have seemed to demonstrate that plants cannot use the nitrogen of the air for food, that it is not in a condition in which they can get hold of it. About ten years ago, however, certain experimenters in this country and in Europe found that in some of their experiments plants did in some way get hold of nitrogen from some source when it was not fed to them; that a plant could be grown in sand absolutely free from nitrogen, and yet in some way that plant got hold of nitrogen; the only source for it was out of the air. That led to further experimentation until within the last four or five years the results have all been pointing in one direction. They seem to show us that there is one family of plants, at least, which is capable of getting hold of nitrogen out of the air. This is the plant family to which the pea, the bean, and the clover belong. It is, in general, the pea family — the *Leguminosæ* family of plants. This family of plants in some way does succeed in getting nitrogen from some source when we do not give it to them as food, and it must be that they get it from the air. And yet those experiments are entirely contradictory to the earlier experiments, which seemed to show that plants could not get hold of nitrogen in the air. The explanation was not found until a few years ago. Two or three years ago some experiments were performed in Germany which have finally led to the solution of the problem, at least in part, and, curiously enough, we find that the whole secret of the matter is connected with these organisms which I am discussing this morning. It is to bacteria that we owe this power which is possessed by plants of the pea family to get hold of nitrogen. If you plant peas in soil containing a certain species of bacteria, or at least certain species of micro-organisms, these micro-organisms crawl into the roots of the pea, and then begin to multiply inside the roots. The little roots begin to swell and there appear upon them a lot of minute nodules, which have received the name of "root tubercles." If I am not mistaken, some of those little root tubercles were shown to the meeting here last evening. These root tubercles, as I say, make their appearance, and it is found that wherever these root tubercles do make their appearance the plant gets hold of nitrogen and grows well. Where these root tubercles do not make their appearance the plants are unable to get hold of nitrogen unless it is fed to them. Now, these root tubercles are produced by bacteria, and these root tubercles are the agencies by which, in some as yet unexplained way, the pea gets nitrogen out of the air.

Thus you see that in the final analysis of the life of a plant, in the assimilation of nitrogen from the air, we are brought to the conclusion that it is the agency of these minute microscopic organisms that is the source of the assimilation of nitrogen from the air by plants. Thus we owe the growth of these plants to bacteria. How the bacteria get the nitrogen out of the air has not yet been explained.

Even before the scientists made this discovery, the farmer had made the discovery practically on his farm. You have known that you could, in some, to you inexplicable, way, rejuvenate an old worn-out soil by cultivating clover upon it, or by cultivating beans. That has been the practice of farmers for years. It has been found that in some way the cultivation of clover, instead of exhausting your soil as the cultivation of some plants does, really increases the fertility of the soil. You cultivate your clover for one season, then the next season you plow the roots into your soil, and you find the field will produce a better crop than before. This result is brought about through the agency of these organisms. The clover belongs to the family of peas, and clover is one of the plants that this particular species of bacteria that I am speaking of can attack. The bacteria in the soil get into these roots, grow in them, produce these root tubercles, and by means of these the clover gets nitrogen out of the air and stores it up in its roots. The next season you plow the roots into the soil, and then come the nitrifying bacteria which pull the roots to pieces and decompose them into the condition of nitrates, and then the next season the plant which you sow gets hold of the nitrates which came from the roots of the clover and which has been brought there through the agency of these bacteria. You see, then, that the farmer owes everything to the bacteria.

I think you will find that I am justified in the statement I made at the beginning, that the study of bacteriology to-day is even more truly a department of agriculture than of medicine. The bacteria belong to the farmer more truly, or at least as truly, as they belong to the physician.

Now, I must draw my remarks to a close. Let me, in conclusion, say that we must not think too hardly of bacteria. It is true they are the causes of evil, it is true that they produce disease, but it is also true that they do good. It is true that they are our enemies, but it is also true that they are our closest allies. It is true that without them we could not have our small-pox nor our yellow-fever, we could not have our diphtheria or our scarlet-fever, neither could we have the epidemic which is at present going over this country, nor, in fact, should we have any of our epidemics, were it not for the bacteria. But when we remember that it is through the agency of these organisms that we bake the loaf of bread that comes on to our table, that it is through their agency that the immense brewing industries are able to exist, that it is through their agency that the industries connected with the manufacture of alcoholic liquors are possible; that without them we could not get our vinegar or our lactic acid; that without them we could not make our ensilage; when we remember that these bacteria give the butter-maker the aroma of his butter; when we remember that it is the decomposition products of the bacteria that the cheese manufacturer sells in the market; when we remember their agency as scavengers, how it is that they keep the surface of the earth clean and fresh and pure and in a constant condition for the continued growth of plants; when we remember their value to the soil in decomposing the dead bodies of animals and plants, and thus enabling the same material to be used over and over again for the support of life, and hence making possible a constant, perpetual condition of nature; and when we remember, lastly, that it is only through their agency that plants were originally enabled to get hold of nitrogen at all, and that it is only through the agency of these bacteria that we may hope for a continuance of a supply of nitrogen to the soil,— when we remember all these things, I think we will recognize that the power of the bacteria for good far outweighs their power for evil. Without them we should not have our epidemics, but without them we should not exist. Without them it might be that some individuals would live a little longer, if we could live at all. It is true that bacteria, by the production of diseases once in a while, cause the premature death of an individual; once in a while they will sweep off a hundred or a thousand individuals, but it is equally true that if it were not for them, plant life and animal life would be absolutely impossible on the face of the world.

THE Grand Honorary Walker Prize of the Boston Society of Natural History, a sum of one thousand dollars, has just been presented to Professor J. D. Dana of New Haven. Previous recipients of the prize have been Dr. Joseph Leidy, Mr. Alexander Agassiz, and Professor James Hall.

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.*

On request in advance, one hundred copies of the number containing his communication will be furnished free to any correspondent.

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

The Color Question

A FEW weeks ago (*Science*, March 25) Mr. Milton Bradley wrote to you on this subject, which unfortunately is still in an unsatisfactory state, notwithstanding the researches of Helmholtz and Maxwell. Mr. Bradley is, do doubt, quite right in treating, for the purposes of his system, all the colors of the spectrum as of equal value, but it is by no means as clear as he supposes that the three colors, red, green, and violet, are entitled to be considered primaries in preference to red, yellow, and blue, if any colors are to be thus treated. The fact that Maxwell found the cross-section of a cone of color to be approximately triangular with red, green, and violet at the three corners, proves little as to the real relation between the various colors. It is very easy by means of a prism so to condense a spectrum as that only red, green, and violet shall be visible, and my impression is that some such explanation will be found of Maxwell's supposed elementary green at least. I read with suspicion such statements as that most natural yellows and blues when analyzed by a prism show a large quantity of green in their composition, and that yellow can be produced by mingling green and violet. In the former case the green is due probably to an overlapping of the yellow and the blue, notwithstanding the belief, which is erroneous, that the yellow and blue of the prism will not produce green. Anyone on looking through a prism at different objects can easily devise a mode of causing two spectra to overlap, and thus convince himself that the blue and yellow do actually thereby give rise to green. He can, moreover, make the red and violet rays overlap, and thus form shades of purple. Such being the case, green, although sometimes in overlapping spectra observed by looking through the prism it appears to obliterate the blue, is no more entitled to be called a primary color than purple itself. For all practical purposes all the colors should be regarded as primary, the question of their actual relation being left to be settled by further investigation. C. STANILAND WAKE.

349 North Clark Street, Chicago, Ill.

Family Types.

CAN I ask one or two questions about Mr. Williams's note in the issue of April 15? Does the mother in placental mammals tend to assimilate in respect to blood to the father? Does the result of a study for twenty-five years of one family offer more than the slightest evidence on the point in question? Does the mother frequently acquire diseases belonging to the father indirectly through the child she is carrying? Does each child in a family

CALENDAR OF SOCIETIES.

Women's Anthropological Society of America, Washington.

April 30.—Miss Annie T. Smith, Report of the Committee on the Investigation of Directive Forces in Society; Mrs. York, Medical Inspection of Schools; Miss Sickles, The Ghost Dance.

Biological Society, Washington.

April 30.—The principal paper of the evening was: The Distribution of Land, Water, and Ice on this Continent in Later Geological Periods, by Professor W. J. McGee; Communications: Erwin F. Smith, The Relation of Plants to the Soil; Charles Hallock, Where Salt-Water Fishes Hide: Results of Deep-Water Seining.

Society of Natural History, Boston.

May 4.—J. S. Kingsley, Notes on the Anatomy of Amphiuma.

Publications Received at Editor's Office.

BAUSCH, EDWARD. Manipulation of the Microscope. Rochester, Bausch and Lomb Optical Co. 16°. 128 p. Ill.

CATHCART GEORGE R. Literary Reader; A Manual of English Literature. New York, American Book Co. 12°. 560 p. $1.15.

CHAPMAN, C. H. An Elementary Course in Theory of Equations. New York, John Wiley & Sons. 12°. 98 p. $1.50.

CHURCH, IRVING P. Notes and Examples in Mechanics. New York, John Wiley & Sons. 8°. 144 p., plates. $2.

GORMAN, S. The Discoboli. Cambridge, Museum Comp. Zoöl. 4°, paper. 96 p., plates.

GREELY, A. W. Irrigation and Water Storage in the Arid Regions. Report to the Sec. of War. Washington, Government. 4°, paper. 356 p. Maps.

HURST, G. H. Silk Dyeing, Printing and Finishing. With numerous colored patterns. New York, Macmillan & Co. 16°. 134 p. $2.

LANDAUER, J. Blowpipe Analysis. Trans. by James Taylor. 2d ed. New York, Macmillan & Co. 16°. 190 p. $1.10.

MORRIS, R. ANNA. Physical Education in the Public Schools. New York, American Book Co. 8°. 192 p. $1.

Exchanges.

[Free of charge to all, if of satisfactory character. Address N. D. C. Hodges, 874 Broadway, New York.]

For sale or exchange, Das Ausland, 10 vols., 1882 to 1891, including 6 vols. bound, 4 in numbers. Wheeler Survey, vol. 1, Geog. Report; also vol. 6, Botany; Production of gold and silver in the United States, 1880, '1, '2, '3, '5; Selfridge Isthmus of Darien. Will sell at very low prices. J. F. James, 1443 Corcoran St., Washington, D. C.

For exchange.—A fine thirteen-keyed flute in leather covered case, for a photograph camera suitable for making lantern slides. Flute cost $27, and is nearly new. U. O. COX, Mankato, Minn.

To exchange; Experiment Station bulletins and reports for bulletins and reports not in my file. I will send list of what I have for exchange. P. H. ROLFS, Lake City, Florida.

Finished specimens of all colors of Vermont marble for fine fossils or crystals. Will be given only for valuable specimens because of the cost of polishing. GEO. W. PERRY, State Geologist, Rutland, Vt.

For exchange.—Three copies of "American State Papers Bearing on Sunday Legislation," 1891, $2.50, new and unused, for "The Sabbath," by Harmon Kingsbury, 1840; "The Sabbath," by A. A. Phelps, 1842; "History of the Institution of the Sabbath Day, Its Uses and Abuses," by W. L. Fisher, 1859; "Humorous Phases of the Law," by Irving Browne; or other works amounting to value of books exchanged, on the question of governmental legislation in reference to religion, personal liberty, etc. If preferred, I will sell "American State Papers," and buy other books on the subject. WILLIAM ADDISON BLAKELY, Chicago, Ill.

For Sale or Exchange for books a complete private chemical laboratory outfit. Includes large Becker balance (200g. to 1-10mg.), platinum dishes and crucibles, agate motors, glass-blowing apparatus, etc. For sale in part or whole. Also complete file of *Silliman's Journal*, 1862–1885 (62–71 bound); Smithsonian Reports, 1854–1883; U. S. Coast Survey. 1854–1869. Full particulars to enquirers. F. GARDINER, JR., Pomfret, Conn.

Wants.

Any person seeking a position for which he is qualified by his scientific attainments, or any person seeking some one to fill a position of this character, be it that of a teacher of science, chemist, draughtsman, or what not, may have the 'Want' inserted under this head FREE OF COST, *if he satisfies the publisher of the suitable character of his application. Any person seeking information on any scientific question, the address of any scientific man, or who can in any way use this column for a purpose consonant with the nature of the paper, is cordially invited to do so.*

TRANSLATOR wanted to read German architectural works at sight (no writing). One familiar with technical terms desired. Address "A.," Box 149, New York Post Office.

WANTED.—A position in a manufacturing establishment by a manufacturing Chemist of inventive ability. Address M. W. B, care of *Science*, 874 Broadway, N. Y.

WANTED.—Books on Anatomy and Hypnotism. Will pay cash or give similar books in exchange. Also want medical battery and photo outfit. DR. ANDERSON, 182 State street, Chicago, Ill.

WANTED.—A college graduate with some normal training, to teach the sciences, at $1.800 per year, in a Southern college. A Baptist or a Methodist preferred. Must also be a first-class Latin scholar. A. H. Beals, Box K, Milledgeville, Ga.

A PROFESSORSHIP in Chemistry is wanted by one who has had five years' experience in that capacity. Would prefer to give instruction by lectures and experiments rather than by text-book methods. Would like a position in a college or university where there is a good student's laboratory. Special points of strength claimed are: (1) Thorough control of a class and good order during lectures and recitations. (2) Accuracy in experimenting with chemicals and skill in the manipulation of chemical apparatus. The permission of several distinguished educators has been given to refer to them if required. Would not care to accept a position paying less than $1,500. Address B. E., care of *Science*, 874 Broadway, New York.

ADDRESS WANTED.—Will some one please send the address of the Secretary of the American Philological Society. Also that of Herbert Spencer. "ADDISON," Room 84, 164 Madison St., Chicago, Ill.

ADDRESSES of Old Book Dealers wanted.—Wishing to obtain a number of old books out of print, I very much desire the addresses or catalogues of rare second-hand book dealers. If there is a directory or list of such dealers I should like to obtain possession of one. W. A. BLAKELY, Chicago, Ill.

find the mother more impregnated with the blood of the paternal house? And if so, does this impregnation seriously tend to make the children favor the family that gives them the name? Is the fact of parental influences — the influences here alluded to being those suggested by Mr. Williams, sympathy or antipathy for people frequently seen — thoroughly established? In a love-match is the face of the father more commonly reproduced? If there are reversions to a primitive type, what is the type — one lying on the maternal or the paternal side?

Do family portraits show a uniformity? If they do, is not the question settled? How, then, can the fact that family portraits show a uniformity — that being the point in question — be cited to prove the point in question, that family portraits do, or do not, show a uniformity? J. C. DANA.

Denver, Col., April 27.

AMONG THE PUBLISHERS.

THOMAS WHITTAKER has just published "The Story of the Discovery of the New World," by Frederick Saunders of the Astor Library, illustrated by C. A. Bobbett.

— A. C. McClurg & Co. announce a volume entitled "Direct Legislation by the People," by Nathan Cree. The author gives a brief review of direct government from the earliest times, and of the rise and development of popular representation. He then considers the advantages of combining direct popular legislation with representative institutions, in which direction, he believes, lies emancipation from political corruption. In this connection he examines two remarkable features of the Swiss Government, viz., the *Referendum* and the *Popular Initiative*. The author's standpoint is said to be conservative.

QUERY.

Can any reader of *Science* cite a case of lightning stroke in which the dissipation of a small conductor (one-sixteenth of an inch in diameter, say,) has failed to protect between two horizontal planes passing through its upper and lower ends respectively? Plenty of cases have been found which show that when the conductor is dissipated the building is not injured to the extent explained (for many of these see volumes of Philosophical Transactions at the time when lightning was attracting the attention of the Royal Society), but not an exception is yet known, although this query has been published far and wide among electricians.

First inserted June 19. No response to date.

N. D. C. HODGES,

874 BROADWAY, NEW YORK.

TO THE READERS OF SCIENCE.

PUBLISHER'S ANNOUNCEMENT.

OUR PLANS.

WITHIN the past six months the use of *Science* by scientific men and women as a medium for prompt publication and weekly discussion, has increased very materially, so that the pages are now well filled each week with original matter. As the number of those promising contributions is increasing at the rate of three or four each day, it cannot be long before *Science* at its present size will be too small for the amount of matter offered. We have under consideration therefore an enlargement of the paper by one-half, but must first learn the temper of our constituency as to an advance in price to $5.00, which was the subscription price from the start for four years, up to June 30, 1887. Further, to carry out the proposed enlargement, we shall need five hundred additional subscribers. If you are not already a subscriber, are you willing to aid in making *Science* more worthy of American scientific work by becoming one?

It goes without saying, that the demand for scientific literature is limited, when compared with that for literature which is more to the public taste, so that the receipts of most of the Scientific Journals, in this country, do not pay quite for their printing and paper, to say nothing of the other items of expense. We say this merely to emphasize the fact, that generous and prompt support must be accorded this move if it is to succeed.

Titles of Some Articles Published in *Science* since Jan. 1, 1892.

Aboriginal North American Tea.
Actinism.
Amenhotep, King, the tomb of.
Anthropology, Current Notes on.
Arsenical Poisoning from Domestic Fabrics.
Anatomy, The Teaching of, to Advanced Medical Students.
Astronomical Notes.
Botanical Laboratory, A.
Brain, A Few Characteristics of the Avian.
Celts, The Question of the.
Collection of Objects Used in Worship.
Deaf, Higher Education of the.
Diphtheria, Tox-Albumin.
Etymology of two Iroquoian Compound Stems.
Eye-Habits.
Family Traits, Persistency of.
Fishes, The Distribution of.
Fossils, Notice of New Gigantic.
Grasses, Homoptera Injurious to.
"Healing, Divine."
Hemipterous Mouth, Structure of the.
Hypnotism among the Lower Animals.
Hypnotism, Traumatic.
Indian occupation of New York.
Influenza, Latest Details Concerning the Germs of.
Infant's Movements.
Inventors and Manufacturers, the American Association of.
Iowa Academy of Sciences.
Jargon, The Chinook.
Klamath Nation, Linguistics.
Lightning, The New Method of Protecting Buildings from.
Lissajou's Curves, Simple Apparatus for the Production of.
Maize Plant, Observations on the Growth and Chemical Composition of.
Mineral Discoveries, Some Recent, in the State of Washington.
Museums, The Support of.
Patent Office Building, The.
Pocket Gopher, Attempted Extermination of.
Psychological Laboratory in the University of Toronto.
Psychological Training, The Need of.
Rain-Making.
Rivers, Evolution of the Loup, in Nebraska.
Scientific Alliance, The.
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Will, a Recent Analysis of.
Wind-Storms and Trees.
Wines, The Sophisticated French.
Zoology in the Public Schools of Washington, D. C.

Some of the Contributors to *Science* Since Jan. 1, 1892.

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Allen, Harrison, Philadelphia, Pa.
Baldwin, J. Mark, University of Toronto, Canada.
Barnes, Charles Reid, Madison, Wis.
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Beal, W. J., Agricultural College, Mich.
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SCIENCE

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SCIENCE

NEW YORK, MAY 13, 1892.

THE NEW CHEMICAL LABORATORY OF THE CASE SCHOOL OF APPLIED SCIENCE.

WITH the rapidly increasing attendance in all institutions of learning, it is hazardous to plan buildings for educational purposes with only sufficient room for present needs or for prospective growth in the immediate future. Every prosperous institution has abundant evidence of this fact in the necessity for enlarging buildings that a dozen years ago or less were regarded as ample in their accommodations, or in extension, especially in the earlier years of a school of science. The building was therefere given a plain, rectangular form, and it was found that extension of the main hall into a wing of any size would not interfere with a convenient arrangement of the rooms for present use.

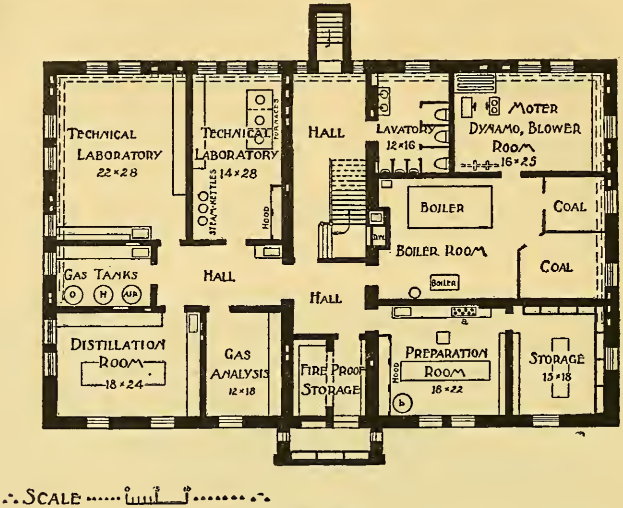
As shown in the plans two stories are included beside a high basement and an attic floor. Each story is 16′ high, and the attic is the equivalent of another story, through the aid of large dormer windows, leaving still an ample space above for general storage. The basement is 13′ high, and the floor 4′ 6″ below grade. An elevator, capable of carrying a load of several hundred pounds, connects with all the floors above the basement.

Laboratory Case School Applied Science, Cleveland, Ohio.
Buff Amherst Stone. S. R. Badgley, Architect, Cleveland, Ohio.

the overcrowded condition of those that do not admit of extension. This is especially true of the chemical laboratory, in which within fifteen years the demand for practical instruction has increased several fold. In some respects provision for prospective enlargement is not consistent with the best construction of a laboratory, yet with the necessity of providing for elementary laboratory training of large freshmen classes still rapidly increasing in numbers, it would be unwise not to include ample provision for future growth.

In devising plans for this laboratory, while I felt that it was not good economy to construct a building several times larger than present needs demanded, I was impressed with the importance of providing for the possibility of unlimited

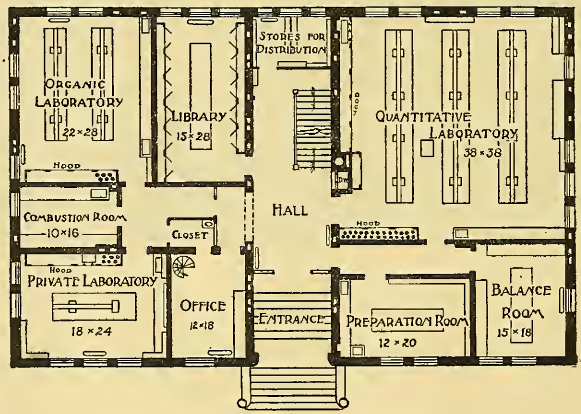
The outside walls of the building are of Amherst sandstone, with all inside surfaces of stock brick laid in red mortar, except within the hoods a special form of vitrified brick is laid. The basement floor is of Portland cement throughout, and the quantitative and general laboratories have floors of asphalt laid $1\frac{1}{4}$″ thick. All flues for hood ventilation are built into the cross-partition walls, the outside wall carrying the inlet flues for room ventilation to the basement, where they are connected by a 14″ iron pipe, shown by the dotted lines near the outside wall, to the blower in the motor room. The position of the three horse-power motor, blower, counter-shaft, and a steam coil for heating the air when necessary are shown in this room. A large tubular boiler supplies steam for laboratory uses, beside heating the building. It is inclosed in brick, and air is brought into the enclosed space through an outside flue and carried to the quantitative laboratory above, which is sufficiently warmed by this means even in the coldest weather without the aid of



BASEMENT.

steam. The smaller boiler is for high-pressure steam, and it is connected into the pipe supplying steam to the laboratories.

In the preparation room, on this floor, the janitor prepares solutions and other material in general use throughout the laboratory. A large steam sink, *a*, with holes of sufficient size to admit a three-litre flask, is extremely convenient for



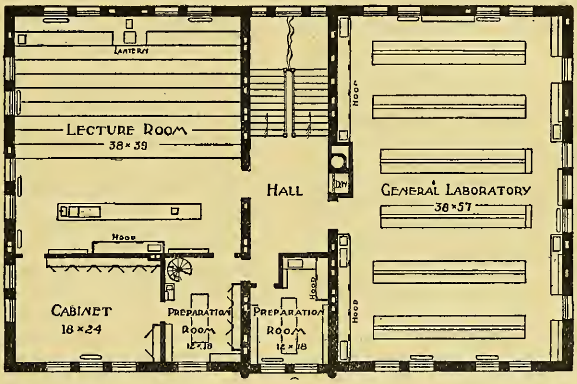
FIRST STORY.

making solutions. The tank, *b*, supplies hydric sulphide through lead pipes to the larger working-rooms. The space under the entrance steps is enclosed in masonry and iron doors for the storage of inflammable material. Distillations are conducted on slate tables in a room with the wood-work covered with sheet-iron. For lighting the central hall the doors of the adjacent rooms are glazed. Three gas tanks, each with a volume of 50 cubic feet, supply gases to the combustion-room directly above and to the lecture-room.

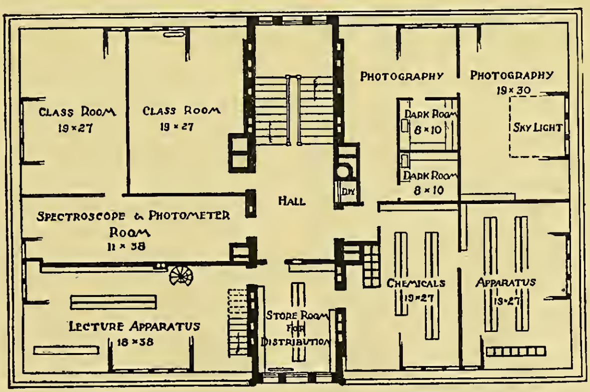
The quantitative laboratory on the first floor has 48 desks covered with porcelain tiles, like the other working tables on this floor. A steam hood has separate cups for evaporation, and the space beneath is enclosed for drying closets; it has a metallic lining with a large steam coil and wire shelves. In the general hood are two copper plates, each 18″ by 20″, above long burners for temperatures higher than 100°. The smaller hood contains the air-baths. Hydric sulphide is delivered from the lead pipe directly beneath a flue-opening. All hoods are glazed throughout with sashes running between a stationary inner and an outer sash, to protect the cord and to extend the efficiency of the hood to the lower level of the running sash. To avoid obstructing the space with pillars, the ceiling of this laboratory is supported on a heavy iron plate-girder thickly covered with asphalt paint. The organic laboratory has accommodations for twenty students, and as in most of the working tables on this floor and the basement there is an abundant supply of steam, water, and waste pipes for distillations and other uses.

The general laboratory on the second story contains ninety-six desks capable of accommodating one hundred and ninety-two students, and the light and ventilation[1] are all that could be desired. At either end of the outside aisle is a case of drawers beneath a table for material in sufficient quantities for large classes, and several shelves contain large bottles for solutions. The blast lamps in this laboratory and in the other principal rooms are supplied with air by a small pressure blower driven by the motor in the basement.

In the lecture-room 200 persons can be seated comfortably. The lecture-table is supplied with gas, water, steam, oxygen, hydrogen, blast, suction, and an excellent draught. In front of the hood are suspended two blackboards, one supporting the other, and a curtain falls from a spring-roller for lantern illustrations. In the rear of the lecture-room are the cabinet for collections and a preparation room, which is connected by a spiral stair with the office and with the room above, which serves for storage of lecture apparatus. The large dormer windows render the rooms on the third floor as serviceable for certain uses as they would be on a lower floor. A large amount of available room is thus secured without extending the outside walls to form a third story. A section of this floor devoted to photography contains two rooms, one with two dark closets for students and instructors, the other with a large skylight for general work. Extension of the roof without interruption affords sufficient height to the flues to ensure good draught. The tops of the flues are eighty feet from the basement floor. Within the space enclosed in brick for the elevator, a stand-pipe is carried to the attic floor, with an opening, on each story, to which is attached a hose of sufficient length to reach every room.



SECOND STORY.



THIRD STORY.

Excavation for this building was begun June 1, 1891, and by the middle of February, 1892, all the working-rooms were in use. In the preparation of the working-plans, the architectural features, and in the substantial construction the trustees were fortunate in securing the skill, good judgment, and faithful service of the architects, Messrs Coburn and Barnum. Of the illustrations in this paper, the excellent view of the building is due to the courtesy of the Cleveland

[1] A description of the ventilation of this laboratory will appear in the American Journal of Analytical and Applied Chemistry.

Stone Company, who furnished the Amherst stone, and the reproductions of the floor plans to the kindness of the architects. CHARLES F. MABERY.

THE STATUS OF EXPERIMENTAL AGRICULTURE.

THE average farmer is eminently conservative when about his routine of work. He dislikes innovations as to methods and distrusts ways and means not clearly "practical." This obtains naturally from his life work. His maintenance depends upon the precarious lives of plants and animals, which in turn, in so far as they as beings are concerned, thrive or perish according to the fiat of life principles, of the working conditions of which, he, in common with the rest of humanity, knows comparatively little. Experiments are costly on the farm, time is cash in hand, and new methods or added work, either apparent or real, must be backed by necessity or success, else the usual method or condition will remain unchanged — "The good old way, good enough."

Because of this general conservatism, held principally in position by the abstruse nature of the principles of life, principles and practice of agriculture advance to place, gain permanence of character, recognition slowly, indeed, in comparison with development of other occupations, even with that of the adoption of farm conveniences, would at first thought seem almost at a standstill, so that, ease of work, convenience, better machinery and appliances, yet seem to leave the yield of labor much on an old-time basis.

This is the dark side of the prospect of agriculture; that, after all the years of man's efforts on the soil, virgin lands still predominate in yield, and regions once prosperous are no longer up to the standard of the new. Belief that such should of necessity have occurred, or that the present new shall eventually become as the old, need not here be disclaimed,— conditions differing much from those of old militate against such retrogression. The true agriculturist no longer rushes blindly along with or against working principles of nature, — taking all or getting nothing according as her resources yield to methods used, — but stands in many aspects master of principles which, under rational control, constantly tend toward lasting improvement, greater returns in every field of labor.

Aside from that which accrues from rapid general enlightenment, many factors unite in this country to place principles of agricultural pursuits upon a higher plane, amongst which may be named the rapid occupation of available wild lands — the removal of a strong incentive to those of most changeful mood as to locality. But by far the most hopeful aspect, the condition most distinctive of agricultural development, is the recognition of the idea of experiment and the value of such effort upon the farm. Many, indeed it may be said almost all of the most enlightened, successful farmers spend a great part of their individual time in work of an experimental nature, such work as a few years since would have been spoken of as "puttering boy-play." While, as previously noted, agriculture as an occupation has in general, from the beginning, made less definite systematic advance as to principles of action than that noted in other professions, this can scarce be said of its later years. Indeed, it is hardly to be questioned that in the last decade greater progress has been made in agriculture as a science, more definite principles of procedure gone into test than in all other occupations of the country. Never before has the farmer been so willing to accept, try new methods, acquiesce in scientific theories and demonstrations; questions that never broke through the cloud of sadness mantling the face of the fate-beridden agriculturists of yore are handled, discussed, and worked upon in the light of experimental effort, often with results most pleasing and not without pleasure even in case of economic failure; for, with men who compile results, negative ones are no longer considered as not to be counted. Questions concerning effect of crop on soil, soil on crop, crop on that which follows are in test by every cultivator of enterprise; stock-breeding is made to follow definite laws of development, desert lands made to yield, and diseases of plants and animals, that of old were pests sent by chance or the Evil One, not to be availed against, meet a man actively prepared to resist according to the dictates of reason and direction of those who have previously succeeded or may authoritatively advise.

While the average farmer is thus markedly in an experimental mood, willing to test as is best known, few have time or bases of fact for initiation of experiments. Herein lies the legitimate work, duty of the experiment station, and with wise provision of the general government, every State and Territory in the country is possessed of such an institution. From the first establishment of these institutions, the impetus given to proper agricultural investigation has been most noteworthy. While more has generally been expected of them than has been forthcoming, yet in this connection it is to be remembered that experimental facts are established only after a proper lapse of time. Nevertheless, much of the work, as shown in the published reports and bulletins, is more fragmentary and less indicative of efficient experimental effort than an enthusiast would wish.

There are numerous reasons for the unexperimental indication of many station publications pertinent to anyone conversant with such work. But, aside from all such apparent elements as may vex the ultra-scientific mind, none bears heavier upon the future usefulness of the experiment station than the varying ideas within the stations themselves as to the true mission of the experiment station. Is it primarily educational for the dissemination of facts not commonly known, or is it experimental — to delve after that which is unknown? Among the stations, types of both are to be found, but many are hybrid. Few publications outlining attempts at pure experimentation are open to harsh criticism, but many most lamentable conglomerates appear as the result of the other two ideas. Perhaps attempt at methods "practical" and writings "popular" is an *ignis fatuus.*

Closely associated with this indecision of purpose is the point of how much should be undertaken. In general, it may be said of the individual stations that too broad a field is attempted, considered from the standpoint of the whole force, and with few exceptions with reference to individual work. Only such an expansive (more properly, perhaps, filling) effort, or a disregard of the literature of the subject, could result in a *résumé* upon "Wheat Rust (*Uredineæ*)," appending a recommendation of same preventive applied to smuts of small grains. In this connection remarks upon the effect of unfortunate recommendations upon experimental ardor of the farmer are unnecessary.

With the possible exception of experiments directly relative to the soil, results of scientific worth reached at any one station will commonly be found generally applicable. In order to attain something like systematic effort, and to prevent useless, costly repetition, it may yet be found effectual, necessary, to league the experiment stations of the country. Each station could support one or two departments of investigation without materially curtailing effort in either; it cannot do all.

Though waning, much evil to true experiment is centred about an idea based upon the much abused words practical and popular, i.e., the farmer should see from the results, good crops, fine stock, etc., that the station is practical — it must be popular. Such a condition is well, but may be a delusion so far as experiment is concerned. It is not enough for an experiment station to show that it has been able to raise an average of forty bushels of No. 1 hard wheat per acre, for a period of ten successive years. It is not enough to compile facts merely for educational (popular) effect. The farmer who is looking for properly initiated experiments, the man who is able to appreciate such and profit by them to the enlightenment of his less able, less active neighbors, while he may be interested in such evidences of capability, rightfully expects more. The station management which, after a decade, has only succeeded in well accomplishing work similar to that indicated will nevertheless be in logical position to answer the question: In how much have you augmented the aggregate of working principles of agriculture?

H. L. BOLLEY.

Government Experiment Station, Fargo, N D.

NOTES AND NEWS.

MISS AMELIA B. EDWARDS, who died recently, has in her will endowed a Chair of Egyptology. Her library, which is very valuable, she has bequeathed to Somerville Hall, Oxford.

— Professor Liversedge, of Sydney, in a recent paper, states that iron rust is usually considered to be an hydrated sesquioxide of iron; but, on examining a very large number of specimens of rust from many different places and formed under a great variety of conditions, he found that in almost every instance the rust contained more or less magnetic oxide, in fact, in some cases the rust, though presenting the usual rust-brown color and appearance, was, when powdered, wholly attracted by a magnet.

— In addition to the Grand Honorary Prize placed at the disposal of the Boston Society of Natural History, by the late Dr. William J. Walker, " for such investigation or discovery as may seem to deserve it, provided such investigation or discovery shall have been made known or published in the United States at least one year previous to the time of award," which has been unanimously awarded to Professor James D. Dana, referred to in *Science* of April 29, the Society has awarded, from the annual Walker Prizes, a first prize of one hundred dollars to Baron Gerard de Geer of Stockholm, for an essay entitled " On Pleistocene Changes of Level in Eastern North America," and a second prize of fifty dollars, to Professor William M. Davis of Cambridge, for an essay on " The Subglacial Origin of Certain Eskers."

— Mr. James M. Macoun of the Canadian Geological Survey Staff, who accompanied the British Commissioners to Behring Sea last year as secretary, has left Ottawa *en route* for Alaska, to observe the habits of the fur seal during the present season. It is proposed that he shall go over the same ground which the Commission traversed last year, to examine specially whether there is any variation in the numbers of the seals. Last year the photographer of the expedition succeeded in obtaining a large number of excellent views of the rookeries, which will furnish a good basis for comparison with a similar set to be taken this summer. Mr. Macoun expects to spend the early part of the season on the Aleutian Islands, proceeding to the Pribyloff Islands only when the seals gather there for the summer.

—It is well known that serious loss is caused in the various Australian colonies by the ravages of the rust fungus in wheat. An Intercolonial Conference, as we learn from *Nature*, met to consider the subject in 1890, and this body has since held two other meetings, the third having taken place at Melbourne last month. Many experiments have been made, and it has been clearly shown that there are several varieties of wheat which, except under very unusual circumstances, are never seriously attacked by rust. It has also been shown that in many districts early sown wheats of a rust-liable kind generally escape damage by rust, when the same wheats sown late suffer seriously. In view of these facts the Conference has directed attention mainly to encouraging the growth of varieties less liable to be attacked by rust, and also to early sowing. At the March meeting it was recommended that a practical system for the production and distribution of rust-resisting wheats suitable to different districts should be immediately established, and that this system should, subject to modifications needed by each colony, be conducted on the following lines: A central station for each colony for the preliminary testing of new wheats introduced into the colony; for the production of new varieties by cross-fertilization and by selection; and for the distribution of suitable wheats thus obtained to representative districts of the colony, to be there subjected to a sufficient test, and, if necessary, fixed in their characters by farmers and others competent for the work; and that such wheats as pass satisfactorily this test should then be distributed to the farmers around in such a manner and by such agency as would be most suitable to the conditions of each colony. A committee was appointed to take steps for the proper naming of the different varieties of wheat.

— At the meeting of the Royal Meteorological Society, the 20th of April, a paper was read on " Anemometer Comparisons," by Mr. W. H. Dines. This was a report on a valuable series of experiments which have been carried out at the request of the Council of the Society with the view of obtaining a direct comparison of the various anemometers in common use, so that some opinion might be formed as to which type of instrument is the most suitable for general purposes. The Meteorological Council have defrayed the cost of the work. The anemometers which were compared were: 1, Kew-pattern Robinson; 2, self-adjusting helicoid; 3, air-meter; 4, circular pressure-plate (one foot in diameter), and 5, a special modification of tube anemometer. Most of these instruments are of the author's own invention, as well as the apparatus for obtaining automatic and simultaneous records from all the instruments upon the same sheet of paper. It appears that the factor of the Kew-pattern Robinson is practically constant and must lie between 2.00 and 2.20. The helicoid anemometer is quite independent of friction for all excepting light winds, and different sizes read alike, but it is not so simple in construction as the cup form. The air-meter consists of a single screw-blade formed of thin aluminium, and made as nearly as possible into the exact shape of a portion of a helicoid. A similar instrument with a larger blade and with the dial protected from the weather would probably form a useful and correct anemometer. It would be light and offer a very trifling resistance to the wind. The oscillations of the pressure-plate must have been considerably damped by the action of the floating weight, but as it was they were sufficiently violent. It seems probable that the remarkably high values sometimes given by the Osler pressure-plate may be due to the inertia of the moving parts. The tube anemometer appears to possess numerous advantages. The head is simple in construction, and so strong that it is practically indestructible by the most violent hurricane. The recording apparatus can be placed at any reasonable distance from the head, and the connecting pipes may go round several sharp corners without harm. The power is conveyed from the head without loss by friction, and hence the instrument may be made sensitive to very low velocities without impairing its ability to resist the most severe gale.

— In *The Studio* for May 7, Mr. Gaston L. Feurardent has an article reviewing the one written by Mr. Edward Robinson of the Museum of Fine Arts of Boston, Mass., and published in the *Century Magazine* for April: "Did the Greeks Paint their Sculptures?" Mr. Feurardent, while giving Mr. Robinson full credit for the research and learning so amply shown in his article, finds himself unable to accept his conclusions so far as they relate to the painting of marble statues of the higher class.

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THE POSSIBILITY OF A REALIZATION OF FOUR-FOLD SPACE.[1]

ANY magnitude that is a function of a single variable may be represented geometrically by a straight line. Functions of two variables are represented by curved lines or by plane areas; and functions of three variables by either twisted curves, curved surfaces, or volumes. The conceptions of length, area, and volume when used in this way are evidently independent of any of the properties of matter except extension. The question now before us is this, Can we develop and use in a similar way a space-concept which can fully represent a function of four independent variables?

Perhaps most of us can remember times in the course of our education when new conceptions of quantity entered into our conscious life, conceptions which correspond in a general way with those of length, area, and volume, in that they enable us to find at once such relationships as are most frequently required for practical purposes by a general, synthetic, instinctive method. A medical student, instead of memorizing the exact amount of each dose under all possible conditions of the patient, fixes in his mind as in a frame work the medicinal outline of each drug. The student of chemistry does something similar with the elements; the architect has such a concept of structural beauty; the hunter, of the most likely place for game. The sense of propriety, the sense of honor, and numberless other "inbred" or "instinctive" concepts are examples of this mental tendency. There is therefore nothing inherently absurd or improbable in the supposition that any of us may attain to a conception of four-fold space, "as clear as the designer and the draughtsman have of three-fold space."[2] Such a conception would be of great value to all classes of scientists. The biologist could set in this four-fold framework a complete picture of genetic or race relationships; the theologian could use it for the world of spirits; the physicist for forces, etc. By this means ordinary men may become able to see and to develop easily new truths, such as are now revealed only to men of genius and inspiration.

It may be objected that our conception of three-fold space is derived directly from sensations in three fold space, and that the conception of four-fold space cannot be derived in a similar way, nor yet from sensations in three-fold space. But it is evident that from any sense, from sight, for instance, we get at most a two-dimentional sensation, and it is only by the kind of changes that occur in the sensation that we can infer that a given retinal picture represents extension in two or in three dimensions. In other words, granting, for the sake of the argument, that in sight we perceive directly the existence of two dimensions, it is clear that the existence of a third dimension is solely a matter of inference. It is the simplest hypothesis we can get to explain our sensations. It is conceivable that the hypothesis of a fourth dimension, if it could be made as real to us, might be found of nearly equal value in the simplification of ordinary phenomena. This would be the case if ordinary phenomena involve motion in four independent directions, or if some of the relations of things in the universe, relations not in space, are capable of complete representation in four-fold space. But before we can decide whether or not space and objects of four dimensions exist we must have our ideas of four-fold space developed sufficiently to know what sensations, what visible and tangible phenomena, would be obtained from objects of four dimensions. Up to this time discussions on the reality of four-fold space have been (necessarily) characterized by the absence of evidence for or against.

To develop a clear conception of four-fold space only one course seems to be open, namely, the synthetical study of four-fold geometric figures in the same way that we now study geometric solids. Having given the number and form of the boundaries of a solid we can, by the process of visualization, find more or less easily its appearance (plane projection) in various positions, the possible plane sections, the distance between any two of its points, and so on. In the study of a tessaract (four-fold figure) we should deal similarly with its solid boundaries, finding the possible solid sections, solid projections, and so forth, studying the tessaract by means of conceptions already familiar (length, area, volume), but in new relations. It this way may be developed gradually such a knowledge of the properties of tessaracts as will enable us to "see" them clearly, and to comprehend quickly a new shape. Models of the solid projections and sections are indispensible to rapid progress. Difficulties may, in general, be overcome by considering the analogous difficulties an imagiuary plane being, that is to say, a being who has no conception of volume, would have in trying to understand a geometric solid.

The First Lesson.

A point moving in one direction traces a straight line. A line moving perpendicular to itself, in one plane, traces a square; and a square moving similarly traces a cube. How could a plane being learn the number and relations of the faces of a cube? He could readily understand that as the square moves in a direction perpendicular to all of its sides each side traces a new square, and that the moving square in its first and last positions forms the remaining pair of opposite faces. In this way he could count up the six faces, twelve edges, and eight corners of the cube, and might pro-

[1] Digest of a paper read before the Canadian Club of Clark University by T. Proctor Hall, Ph.D

[2] "A New E a ot Thought," by C. H. Hinton, M.A.

ceed to make models of the faces as follows (Fig. 1). The side *ab* of the original square *abcd* traces the square *abfe*, which he places, as in the figure, in the only position known to him subject to the condition that *ab* is one of its sides. The three other squares are similarly placed as in the figure, and now five of the six squares are shown in positions which are correct with reference to their generating lines. But the corner *a* is in this figure represented as the generator of two lines *ae*, which is evidently incorrect. The outer squares

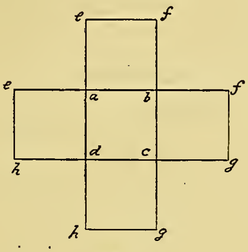

FIG. 1.

are therefore to be turned through 90° about their generating lines until the two lines *ae* become one and the four spaces between *ee*, *ff*, *gg*, *hh*, disappear. He cannot imagine how this is to be done, but he can suppose the central square to move away and disappear in the to him unknown direction, carrying with it the outer squares which would then appear to sink into the centre and disappear as they reached their generating lines until at last the lines *ef*, *fg*, *gh*, *he* reach the position now occupied by the sides of the square *abcd* and become in the picture, what they are really, the sides of the sixth square *efgh*. Supposing, in the next place, that the square *abcd* as it moves away is still visible, but smaller by perspective, the plane being could construct a model which is to us a perspective view of a cube and which would represent to him fairly well the relations of the boundaries of a cube (Fig. 2).

Let us proceed in the same way. A cube moving in a direction perdendicular to all of its faces traces out a rectangular tessaract. Each face traces a new cube, each line a square, each point a line. Counting up we find the tessaract

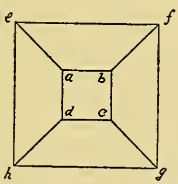

FIG. 2.

is bounded by 8 cubes; has 24 squares, which do not enclose the tessaract, but appear here and there as lines do upon a cube, interfaces, not surfaces; 32 lines or edges, and 16 angular points. A little calculation now shows that each face is common to two cubes, each line to three faces, and each point to four lines. All this seems very abstract, but it becomes real and evident when we make a model. Placing a cube on each face of the original cube, after the analogy of the plane being's squares, we have these six cubes in the only positions known to us which satisfy their genetic conditions (see Fig. 3). The eighth cube is represented by the outer faces of the six cubes, and it is evident that the three lines marked *cC* are really one, the two faces *bC* are one face, and so on. We may now imagine the central cube to move away in the fourth dimension and the others sink inward and disappear as they reach the present boundaries of the central cube, where they turn at a right-angle into the new direction. Finally all the outer faces will meet as the boundaries of the eighth cube *DF*. Supposing the cubes elastic, we may stretch their outer faces and diminish the inner until we obtain the perspective view of a tessaract, as shown in Fig. 4, where the relations of the various boundaries of the tessaract are more easily studied. Incidentally we have learned also that a solid section of the tessaract, when taken parallel to a cube-boundary, is a cube.

The Second Lesson.

Turning again to our imaginary plane being for suggestions, let us see how motion in the third dimension would appear to him. If a cylinder were passing perpendicularly through his plane he would see only a stationary circle, or if it were oblique, a moving ellipse. A cone would appear as a growing or diminishing circle, a beaded rod as an oscillating circle, a corkscrew as an ellipse moving in a circular orbit, and so forth. The stem of a dichotomous tree would be to him a wooden circle which, as the branches approach,

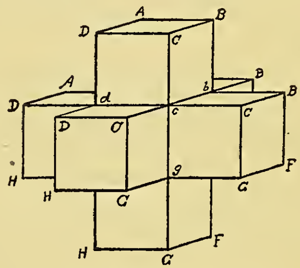

FIG 3.

widens out, becomes constricted, and finally divides into two circles, which repeat the process indefinitely. We may imagine a plane philosopher who, after watching this process for some time, constructs a theory of the evolution of circles. But his idea that all these circles have been developed from one is hardly more than a caricature of the truth.

Every person who has watched the self-division of infusoria under the microscope must be struck with the analogy of these two processes. A little reflection enables us to see that race-unity may be more than a figure of speech or a creation of the fancy; that the organic forms that existed for us yesterday and those that will exist for us to-morrow may be but parts of larger units of which the forms we see to-day are only solid sections. True, this is only a suggestion; but it is a suggestiou that carries with it an unavoidable sense of freedom, of fetters loosed, of largeness, and of reality, to anyone who will for a time yield himself to its influence. It is a step toward the poet's view,

> "All are but parts of one stupendous whole,
> Whose body Nature is, and God the soul."

If four-fold space exists, it is evident that it must contain an infinite variety of three-fold spaces, of which we know only one. It must also be everywhere possible for a four-fold being to step out of our space at any point and re-enter it at any other point; for his relation to our space is nearly the same as our relation to a plane. If ghosts are four-fold beings, the erratic nature of their movements may become more comprehensible in the course of time. An ordinary knot could in four-fold space be readily untied by carrying one loop out of our space and bringing it back in a different place. In fact, a knot in our space would be simply a loop or coil in four-fold space. A flexible closed shell could be turned inside out as easily as a thin hoop can with us; and many other apparent impossibilities become mere child's play. But the realization of four-fold space cannot be learned by giving attention to such little curiosities as these. Only a systematic and continued study of the figures and motions of higher space can be expected to give results of

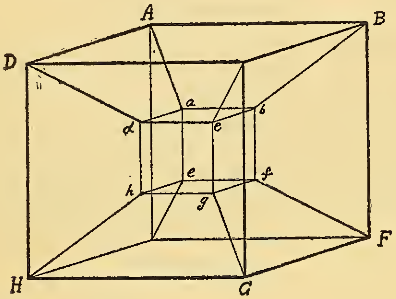

FIG. 4.

educational value. And when (or, if) our conception of four-fold space becomes clear, we shall be ready to recognize the existences and motions of the fourth dimension if there be such.

THE TUSKALOOSA FORMATION.

PROFESSOR LESTER F. WARD has recently spent a couple of weeks in Alabama in making a study of the Tuscaloosa formation, both as to its stratigraphy and its fossil plants. While in Alabama the professor made Tuscaloosa his headquarters, and from there made a number of short excursions in company with Dr. Eugene A. Smith to places of interest. At Cottondale, some eight miles east of Tuscaloosa, there is a fine locality for the collection of fossils, chiefly well-preserved leaf impressions. Professor W. M. Fontaine, a number of years ago, spent some time here and collected a great number of these leaves, which are now in the hands of Professor Ward for study and description.

Between Cottondale and Woodstock there are many occurrences of the Tuscaloosa sands and clays, which are now only outlying remnants, upon the rocks of the Coal Measures, of what was once probably a continuous mantle. Although there are many places where excellent clays for economic purposes are to be seen, none of them thus far examined have been found to contain the leaf impressions. From their position, these beds, occurring between Cottondale and Woodstock, appear to be the oldest of the Tuscaloosa series, and the leaf-bearing beds thus appear to be tolerably well up in the formation, although wherever seen, at Cottondale, Tuscaloosa, Snow's, Shirley's Mill, Glen Allen, etc., the leaf-bearing clays rest directly and unconformably upon the Coal Measures, usually within thirty or forty feet of the lin of contact of the two formations.

The other localities mentioned above, except Glen Allen, being away from the railroad lines, had to be reached by private conveyance.

Snow's, about seven or eight miles west of Tuscaloosa, was first examined by Dr. Smith seme years ago, and Professor Fontaine made a large collection here also. In the gullies near Snow's there is fine opportunity for seeing the strata of the Tuscaloosa formation, in vertical section. One of these is more than one hundred feet deep. Shirley's Mill, eleven miles south-east of Fayette Court House, was first made known as a plant-bearing locality by Dr. George Little, who visited it last year while making an examination of the Tuscaloosa clays, for the Geological Survey of the State. Dr. Little brought back a few fine leaf impressions from here, but Professor Ward was the first to make a systematic collection of the fossil plants. Glen Allen, on the Kansas City, Memphis, and Birmingham Railroad, was first examined and a small collection made by Dr. Smith several years ago, but here again Professor Ward was the first to collect on a large scale. The leaves are in a dark colored clay that at certain stages of wetness is tough and intractable, but when properly dry yields beautiful specimens at every stroke of the hammer. The same is true of the clays near Shirley's Mill, and at both these places one can in a few hours load a wagon with fine cabinet specimens.

The Tuscaloosa formation is now generally considered a member of the lower Cretaceous, in part at least equivalent to the Potomac of McGee. While the fossils have not yet been sufficiently studied to decide their exact equivalence, many of the leaves appear to be identical with those occurring in the Amboy clays of New Jersey.

While in Tuscaloosa Professor Ward had an opportunity also of collecting some rare living plants. Upon the banks of the Warrior River, a few miles above the town, under the guidance of Drs. Bondurand and Hall, he was able to obtain *Neviusia Alabamensis*, *SedumNevii*, *Croomia pauciflora*, all comparatively rare, the first named having been found only in this locality. In Dr. Smith's yard is growing the *Croton Alabamensis*, recently discovered on the banks of the Cahaba River, and of interest as being the only shrubby Croton in our North American flora. This one grows to the height of eight or ten feet and makes almost impenetrable thickets. When slightly bruised the leaves and stems give out a fragrance somewhat like that of the flowers of the crab-apple.

An excursion was also made by Dr. Smith and Professor Ward to a little village, Havana, some twenty-five miles south of Tuscaloosa, long known to the former as an interesting locality, where, in a rocky glen under overhanging cliffs, grow two rare ferns, *Asplenium ebenoides* and *Trichomanes radicans*. The former has been noted from only three other localities, all in different States of the Union. Near Havana there are some great gullies, locally known as "The Caves," in which the micaceous sands of the uppermost of the Tuscaloosa formation are laid bare. These sands are remarkable for their brilliant colors, red, pink, purple, and yellow. In this respect they called to mind the similar bright hues of Gay Head in Massachusetts.

E. A. S.

MR. W. J. HUSSEY of the Ann Arbor Observatory has received an appointment as astronomer at the Leland Stanford, Jr., University.

ASTRONOMICAL NOTES.

[Edited by George A. Hill.]

Comet *a*, 1892.

The following ephemeris of comet *a*, 1892, is from a hyperbolic orbit computed by Father G. W. Searle of the Catholic University, and is based upon observations made on March 10, March 29, and April 22, and represents very closely an observation made by Father Searle on the morning of May 6. The epoch is for Greenwich midnight: —

	R.A. h.	m.	s.	Dec. °	′	log △.	Br.
May 12	23	5	17	+ 28	5.3	0.1270	0.61
13		8	0	28	39.9		
14		10	42	29	13.7	0.1329	0.58
15		13	22	29	46.9		
16		16	1	30	19.4	0.1387	0.55
17		18	38	30	51.3		
18		21	14	31	22.5	0.1444	0.52
19		23	48	31	53.1		
20		26	20	32	23.2	0.1499	0.49
21		28	50	32	52.7		
22		31	19	33	21.6	0.1553	0.46
23		33	47	33	49.8		
24		36	13	34	17.4	0.1606	0.44
25		38	37	34	44.6		
26		40	59	35	11.3	0.1657	0.42
27		43	19	35	37.4		
28		45	38	36	3.0	0.1707	0.40
29		47	55	36	28.1		
30	23	50	11	+ 36	52.7	0 1756	0.38

Winnecke'e Perodic Comet.

Ephemeris continued from No. 482 of *Science:*—

	R.A. h.	m.	s.	Dec. °	′
May 17	11	10	3	+44	29
18		8	50	44	27
19		7	39	44	24
20		6	28	44	21
21		5	19	44	17
22		4	9	44	13
23		3	0	44	9
24		1	50	44	5
25	11	0	40	44	0
26	10	59	30	43	55
27		58	18	43	49
28		57	5	43	44
29		55	50	43	38
30		54	33	43	32
31		53	13	+43	25

Bright Streaks on the Moon.

Professor Holden in No. 22 of the Publications of the Astronomical Society of the Pacific calls attention to an interesting question in regard to the system of bright streaks on the moon, which radiate from the craters Tycho, Copernicus, Kepler, and others. These streaks, as he says, are well known objects, and are depicted upon the maps of the moon made by Lohrmann, Beer, and Maedler and Schmidt. Professor Holden offers to place at the disposal of any one who has the time to devote to the research, glass-positives of the moon taken with the great telescope. What is desired is to compare the photographs with the best maps to see if these bright streaks shift as the moon's age varies, or if they are fixed. Professor Holden's kind offer should be accepted by some one who has the time to give the subject careful consideration, as it is not at all difficult and only needs a good supply of patience.

Astronomy and Astro-Physics for May.

Astronomy and Astro-Physics for May contains some very interesting papers. Professor W. H. Pickering describes the mountain station of the Harvard College observatory at Arequipa, Peru, at an attitude of 8,055 feet above the sea. Professor Pickering states that a power of 1,140 on the 13-inch telescope has been used upon Venus in the daytime, that power showing the planet to a decidedly better advantage than 812. The phases of Jupiter's satellites are readily observed as they enter the shadow of the planet, a phenomenon very seldom seen in low altitudes. Professor Pickering sums up the advantages derived from his station in these words, "What we see here depends not, as elsewhere, upon the condition of the air, but only upon the size and quality of the telescope employed."

Mr. J. A. Brashear gives a sketch of the life of G. B. Clark, the great optician. Mr. T. J. J. See links together the history of the color of Sirius. Professor Barnard gives the result of his successful attempt to photograph Swift's comet. Mr. Monck writes on the Spectra and Proper Motion of Stars, and Professor Vogel, on the Motion of Nova Aurigæ in line of sight. Mr. Cortie has Some Recent Studies on the Solar Spectrum. Solar Photography at the Kenwood Astro-Physical Observatory is treated by Professor Hale, and Professor Pickering writes on The Nova in Aurigæ. Other interesting papers follow, besides news and notes of interest to astronomers. Professor Payne and Professor Hale have made a most interesting number in the one that is now before us, and we hope that their endeavors will not be abridged in the future.

IS IT DANGEROUS TO SPRAY FRUIT-TREES WITH SOLUTIONS OF POISONOUS SUBSTANCES IN ORDER TO PREVENT DEPREDATIONS FROM DESTRUCTIVE INSECTS?

The following report of experiments made to determine the amount of copper and arsenic adhering to fruit that had been sprayed with Bordeaux mixture and other compounds is taken from Bulletin 17 of the Hatch Experiment Station of the Massachusetts Agricultural College at Amherst.

Grapes.

During the early autumn the Board of Health of New York City condemned several carloads of grapes as dangerous to the public health and ordered them destroyed, because they were slightly disfigured with the Bordeaux mixture which had been used by the growers to prevent mildew and rot. This caused a "scare" among the dealers and consumers and a serious fall in prices, which affected the market more or less for the rest of the season. To determine positively the amount of copper adhering to the grapes grown in the college vineyard, two lots of fruit, of ten pounds each, were selected, one from vines sprayed with the Bordeaux mixture throughout the season, and which were very badly disfigured, and the other from vines that were treated with the Bordeaux mixture up to the middle of June, then with two applications of the ammoniacal carbonate of copper, and which were not in the least disfigured.

An analysis of these two samples was made at the State Experiment Station. In the first, sample No. 1, there was found only $\frac{2}{1000}$ of 1 per cent of oxide of copper, an amount so small that one would need to eat from one-half to one ton of these grapes, stems, skins, and all, to obtain the least injurious effect, and that, notwithstanding the fact that the bunches were selected from those having the largest amount of the copper mixture adhering to them.

In sample No. 2 not a trace of copper could be found. It would seem from the above that, even under the most careless use of the copper solutions, no injurious effects need be feared, and that when properly applied there will not be a trace of copper left upon the fruit at harvesting.

Apples.

Early in December, the *Pall Mall Gazette* of London, England, published an article headed "American Apples. Alarming Allegations — Are They Doctored with Arsenic?" Then the statement is made "that American orchardists use arsenic in such large quantities to protect their fruit from insects as to completely saturate it, and that the bloom or white powder found on American apples is arsenic, brought to the surface by evaporation, and, if the fruit is eaten, this should be wiped off to avoid injurious effects. That the delicate, unnatural (?) bloom of the American apples is due to arsenic, a drug that is largely used by people, especially the fair sex in America, to make the complexion fair," and other statements equally absurd and without a shadow of foundation. These statements were undoubtedly made in the interest of speculators for the purpose of injuring the sale of American apples in the English market.

To determine the amount of copper and arsenic adhering to the surface of apples (for it could not have been absorbed into the substance of the fruit) which had been sprayed three times with the Bordeaux mixture and Paris-green, twenty apples, measuring one peck, were taken to the State Experiment Station for analysis. The amount of copper oxide found on these apples was twenty-two thousandths (.022) of one grain. This equals about five ten-thousandths (.0005) of one ounce to the barrel, or requiring two thousand barrels to yield one ounce of copper oxide. The specimens selected for this analysis were those with the roughest surface, to which would adhere more of the copper solution of Paris-green than to the average apples.

Not a trace of arsenic could be detected in this analysis, as Paris-green (average samples of Paris-green contain about thirty-three parts of oxide of copper and sixty-one parts of arsenious oxide) was not used after July 1, but it was probably all washed off during the three months following, before the apples were gathered, which was Oct. 1.

When we consider the fact that probably not one fruit-grower in one hundred throughout the country used Paris-green at all, and that not one barrel in thousands came from sprayed trees, the absurdity of the "scare" becomes still more apparent.

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.*

On request in advance, one hundred copies of the number containing his communication will be furnished free to any correspondent.

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

The Ancestry of Chalicotherium.

CHALICOTHERIUM is a genus which appears in the lower Miocene simultaneously in Europe and America, where it has been very recently discovered. It extends into the Pliocene and then disappears. It has attracted unusual attention of late, owing to the discovery by Filhol and independently by Forsyth Major that the foot-bones of *Macrotherium*, which has been considered an Edentate, really belong to *Chalicotherium*. As the teeth are wholly different from those of the Edentates, and similar to those of the Ungulates, this genus represents a very aberrant and unique family.

The only known Ungulates which present a dentition at all similar are *Palæosyops* and *Meniscotherium*. The latter is from near the base of the Eocene, and last year in analyzing its dentition I found so many very striking resemblances to that of *Chalicotherium* that I was led to suggest that *Meniscotherium* might be the long-sought ancestral form, reserving final judgment until the feet were discovered. Marsh has very recently figured the feet of *Meniscotherium* (*Hyracops*), and, upon the whole, I think they sustain the supposition that the *Chalicotheriidæ* were derived from the *Meniscotheriidæ*. There are some profound differences, but these are mainly such as separate primitive from highly modified forms. The resemblances consist in the tridactylism of both genera and the marked similarity in tooth structure. I will discuss these points in more detail in the *American Naturalist* for June. HENRY F. OSBORN.

New York, May 5.

Detection of Artificial Gems.

I WAS much interested in reading an article by Mr. W. G. Miller on the "Detection of Artificial (Imitation) Gems," that appeared in your issue of April 29. The writer states that, 1, hardness is no test for cut stones, because cutting softens the surface; 2, that specific gravity is no test in polished stones, because polishing affects the specific gravity, and because imitation-gem manufacturers made them with a specific gravity as near that of the real gem as possible; 3, that the examination of the optical properties of cut stones is difficult (and therefore presumably impracticable) because of the many facets; 4, that fusibility is the only reliable test. I desire to advert briefly; but first let me say that the title of the article, "The Detection of Artificial (Imitation) Gems," is misleading, and confounds two totally distinct things. *Artificial* gems, such as the rubies of Fremy or the emeralds of Hautefeille, are constitutionally identical with real gems, but are the product of a chemical process, and not the work of nature; whereas imitation gems, such as paste or glass or the so-called doublets, are gems only in appearance, consisting of two or three layers of quartz or garnet and one or more layers of glass of such intensity of color as to tone down or change the quartz or garnet to the red color of the ruby or the green color of the emerald or the blue of the sapphire, according as it is intended to counterfeit one or the other of these. The same confusion is also apparent in the statement that "the ancient Egyptians and Greeks were well versed in the manufacture of artificial stones." That they produced remarkable glass *imitations* is indisputable, — witness the marvellous collections of antique pastes in the museums of Europe, — but it is safe to say that the ancients never produced an *artificial* precious stone of any kind. So much for the title.

Now, second, as to hardness as a test, let me say that I differ entirely from Mr. Miller when he states that the hardness of a precious stone is reduced by cutting or polishing. The hardness is not affected in any way, and so far from cutting impairing the test for hardness it can in point of fact be more delicately given if made on cut and polished stones with properly prepared points made of the various gem minerals than when made on the rough uneven surfaces of uncut and natural minerals. That polishing reduces the hardness by *one-tenth* is ambiguous. Though in the Mohs scale of hardness the sapphire is placed at 9 and the diamond at 10, it would be more in keeping with fact when the abrasive quality or hardness of a diamond is considered to rate the diamond at 100 or even 1,000, so great is the difference between the two. Surely the writer does not mean to imply that, simply by polishing, the hardness of the diamond is reduced to 9 (the hardness of the sapphire), or that the sapphire is reduced to 8 (the hardness of topaz), or that topaz is reduced to 7 (the hardness of quartz). It is well known that *imitation* (not artificial) gems will scratch glass, and there is no reason why they should not. Their hardness is not even as great as that of feldspar, never that of quartz. Popular beliefs are not scientific facts, and it is a scientific fact that nothing but the natural edge of a diamond crystal will cut glass (frequently with very little visible scratching), but everything having the hardness of feldspar will scratch it, as well as glass itself. Popular errors are numerous, and these errors are frequently extensively copied. For instance, a statement appeared some years ago in one of our large magazines that if a precious stone could not be scratched by quartz it would surely be a diamond, and that any jeweller who would object to having a diamond tried with a file should be condemned as a fraud.

Polishing the surface of a precious stone can in no way affect its specific gravity if the stone is properly cleaned, and if the operator has a delicate balance and sufficient experience. In these circumstances it is surprising what exact results the various colors of the various precious stones give us. Further, I may say that, after visiting nearly all the known gem-cutting centres and the chief seats of the manufacture of imitation gems, I have never yet known of an instance where the manufacturer cared the slightest what the specific gravity of his product was, providing it had the desired color, or, if it were to imitate a diamond, it had a greater amount of brilliancy than the material made by one of his most successful competitors. The majority neither know nor care what the specific gravity of the gems is any more than does the regular jeweller.

As regards the optical properties of gems no mention is made of the dichroscope, with the use of which the facetting in no way interferes. The polariscope is also of considerable value. In fact, in the determination of rubies, sapphires, and emeralds, their pronounced optical properties, as shown by the dichroscope, or the polariscope and the spectroscope, together with their specific gravity and their hardness, which is so much greater than that of quartz, will readily distinguish them from everything "imitation." By means of the spectroscope we obtain the red band for the ruby, the absorption bands for the garnet, at D, E, and F in the spectrum, or the series of black absorption bands for the zircon. To distinguish glass from a real ruby requires but a glance; to detect the difference between rubies, spinels, garnets, and rubellite is not so easy, and in these cases fusibility is of no value.

I think the experience of those who have given attention to this matter is, first, that the specific gravity of the various precious stones is remarkably constant according to their color, seldom varying more than one in the second place of decimals, and, second, that the hardness of the gem is also remarkably constant, and that lines can be more clearly drawn in cut than in natural crystals, which are frequently not transparent, owing to impurities; namely, placing the sapphire at 9, the ruby at 8.8, the aquamarine at 8, and the emerald at 7.8.

I should not want to be responsible for the consequences if, at a jeweller's, anyone tried heating a gem in the flame of a spirit lamp or in the flame of a Bunsen burner, any more than I should if a buyer started to try a diamond with a file. Nor should I care to be responsible for the heating in a Bunsen burner of a fine ruby or sapphire, which frequently contains fluid-cavities, or of an emerald, which, if of a fine color, is seldom perfect, owing to internal striæ and fluid-cavities, or the topaz, which is affected by heat, and nearly always contains many minute fluid-cavities. The fusibility of the edges of the gems would not distinguish the artificial rubies of Fremy from those of the true ruby, as both are infusible. Nor would the test of heating in a Bunsen burner be practicable if Mr. Miller were called upon to examine in a few hours from one thousand to fifty thousand gems, and at the same time be perfectly sure that there were no imitation gems in the lot. Such testing needs the experience of the expert, who, before he opens a paper marked "blue or green aquamarine," can tell simply by the weight that the stone in the paper is a blue or green topaz, or who, if the stone is labelled "yellow topaz," can, without looking at it, but simply by the facility with which it slips through the fingers, determine that it is citrine (decolored smoky quartz) or the true mineral topaz; or who, if one hundred stones mounted as rings were placed before him in a tray, without supposing the presence of an imitation stone, could at once detect the single imitation present. Nor would fusibility be of any value in the examination of that class of imitations which are made by dipping heated quartz in green, red, or blue solutions, a common variety of which is known as Mount Blanc, or Alpine ruby.

Finally, few mountings which secure gems are improved by heating them to any extent, and generally the owners do not wish the settings disturbed. As to imitation diamonds there is surely not a jeweller worthy the name who cannot tell a true diamond from a paste one at the first glance, by its adamantine lustre. If it scratches sapphire he may be sure it is a diamond, whereas putting the gem into the flame would not distinguish the diamond from the white topaz or the white zircon or the white sapphire or the white tourmaline or any other white stone that is not fusible.

In conclusion, let me suggest to Mr. Miller the simple test for diamonds, of drawing the stone sharply over a piece of unpainted board in a dark room. Every diamond phosphoresces by friction.

GEORGE F. KUNZ.

New York, May 11.

Artificial Production of Variation in Types.

IN reply to your request for a few words on the question of artificial production of variations, as presented by Mr. West in *Science* of April 22, I may say that I quite agree with Mr. West in thinking that all attempts to produce new species by mutilations of the parents are foredoomed to failure. The idea that the embryo is in any sense a *reflected* image of the parent, and consequently that any particular loss or modification of an organ in the parent during adult life must impress itself upon the embryo, has not a shadow of a basis in embryology.

Mr. West asks, "Would it not seem the proper and only method to study the laws governing the modifications of the embryo?" If we substitute germ-cells for "embryo," the question may be answered affirmatively. If the question, as it stands, implies that modifications received during *embryonic* life, as the result of external influences, would be any more likely to repeat themselves in the next generation than if acquired during adult life, I should say that the assumption is entirely unwarranted.

The form and features of the adult are predetermined in the constitution of the germ-cell. No one denies that external conditions and influences may affect more or less the course of development; but the specific form of the adult is already settled in the germ before development begins. These are mere truisms in embryology.

C. O. WHITMAN.

Clark University, Worcester, Mass.

The "Hongote" Language.

IN a series of ten studies of South American Languages, principally from MS. sources, which I published in the last number of the Proceedings of the American Philosophical Society, one was partly devoted to the "Hongote" language, a vocabulary of which I found in a mass of documents in the British Museum stated to relate to Patagonia. I spoke of it as an independent stock, not related to other languages of that locality. In a letter just received from Dr. Franz Boas, he points out to me that this "Hongote" is certainly Salish, and must have been collected in the Straits of Fuca, on the north-west coast. How it came to be in the MSS. referred to, I cannot imagine, but I hasten to announce the correction as promptly as possible.

D. G. BRINTON, M.D.

Philadelphia, May 4.

AMONG THE PUBLISHERS.

THE number of the *American Journal of Psychology* which is about to appear will contain an article on the variations of the knee-jerk by Dr. Noyes, which contains the results of experiments on a case of dementia. Mr. Bolton contributes a digest of the experiments on memory made by Dr. Boas in the Worcester schools. Mr. Fraser shows the psychological origin of the *naive* realism of the unthinking man and of the philosophic realism of the Scottish school; both are due to a postulate of the sensations of touch as the ultimate realities. The old philosophers have before this served as subjects for clinical investigation or as "Versuchsthiere," but they have seldom been so correctly diagnosed as in Mr. Fraser's last two articles. The *Journal* continues its digests of psychological literature, to which it devotes much care. Such a careful review of the contributions to psychology in its various aspects by specialists in the various lines is believed to be presented by no other periodical; several of the most prominent names of specialists in America will appear as the editors of the different sections, e.g., Professor Donaldson (Nervous System), Professor Cattell (Association, Reaction), Professor Jastrow (Hypnotism), etc.

— The American Book Company have issued a new and revised edition of "Cathcart's Literary Reader," a book of selections from English literature which was first published under the editorship of George R. Cathcart some seventeen years ago. The selections are arranged in periods beginning with the age of Elizabeth and coming down to the present day. No attempt is made to give a complete compendium of English literature, only the leading authors, or those whom the compiler regards as such, being represented; but brief mention is made of many others and of their principal works, so that the volume will serve to a certain extent as an introduction to literary history. The writers of the nineteenth century are accorded the larger share of the space, on the ground that they are more interesting to us than those of earlier times, which is undoubtedly true; but we cannot think the editor's choice in all cases a judicious one. In the earlier periods he follows the general judgments of critics, giving prominence to those writers who are usually deemed the greatest; but in dealing with contemporaries, as he himself remarks, the guidance of established criticism is less available, and his choice, it seems to us, is not always to be commended. The selections in verse are far more numerous than their importance warrants; such verses as those of Poe on "The Bells" and many others that might be mentioned being unworthy of a place in such a collection; while, on the other hand, some of our greatest and most influential prose writers, including John Stuart Mill, John Henry Newman, and Matthew Arnold, are not represented at all. Nevertheless, there is much in the book that is valuable, and it is certainly superior to the ordinary "reading books," which may indeed teach the pupil to read, but which seldom teach anything of the history of literature or inspire a taste for literary excellence.

— The manuscript of Part II. of the "Index to the Literature of Explosives," by Charles E. Munroe, is now ready for printing, and, provided a sufficient number of subscriptions are obtained in advance to warrant doing so, it will be issued in pamphlet form, of approximately 150 octavo pages, at $1 per copy. Part I., issued in 1886, contains the titles of all articles relating in any way to explosives that appear in the *American Journal of Arts and Science*, 1819–1886; Philosophical Transactions of Royal Society, 1665–1882; Journal of Royal United Service Institution, 1857–1885; Proceedings U. S. Naval Institute, 1874–1885; *Revue D'Artillerie*,

CALENDAR OF SOCIETIES.

Philosophical Society, Washington.

May 7.—J. P. Iddings, On the Origin of Igneous Rocks; J. E. Watkins, John Stevens and his Sons, Early American Engineers; H. A. Hazen, Scientific Ballooning.

Appalachian Mountain Club, Boston.

May 11.—J. R. Edmands, Some New Paths and Camps on Mount Adams; W. M. Davis, The Relation of Mount Monadnock to Mount Tom.

Exchanges.

[Free of charge to all, if of satisfactory character. Address N. D. C. Hodges, 874 Broadway, New York.]

For sale or exchange, Das Ausland, 10 vols., 1882 to 1891, including 6 vols. bound, 4 in numbers. Wheeler Survey, vol. 1, Geog. Report; also vol. 6, Botany; Production of gold and silver in the United States, 1880, '1, '2, '3, '5; Selfridge Isthmus of Darien. Will sell at very low prices. J. F. James, 1443 Corcoran St., Washington, D. C.

For exchange.—A fine thirteen-keyed flute in leather covered case, for a photograph camera suitable for making lantern slides. Flute cost $27, and is nearly new. U. O. COX, Mankato, Minn.

To exchange; Experiment Station bulletins and reports for bulletins and reports not in my file. I will send list of what I have for exchange. P. H. ROLFS, Lake City, Florida.

Finished specimens of all colors of Vermont marble for fine fossils or crystals. Will be given only for valuable specimens because of the cost of polishing. GEO. W. PERRY, State Geologist, Rutland, Vt.

For exchange.—Three copies of "American State Papers Bearing on Sunday Legislation," 1891, $2.50, new and unused, for "The Sabbath," by Harmon Kingsbury, 1840; "The Sabbath," by A. A. Phelps, 1842; "History of the Institution of the Sabbath Day, Its Uses and Abuses," by W. L. Fisher, 1859; "Humorous Phases of the Law," by Irving Browne; or other works amounting to value of books exchanged, on the question of governmental legislation in reference to religion, personal liberty, etc. If preferred, I will sell "American State Papers," and buy other books on the subject. WILLIAM ADDISON BLAKELY, Chicago, Ill.

For Sale or Exchange for books a complete private chemical laboratory outfit. Includes large Becker balance (200g. to 1-10mg.), platinum dishes and crucibles, agate motors, glass-blowing apparatus, etc. For sale in part or whole. Also complete file of *Silliman's Journal*, 1862-1885 (62-71 bound); Smithsonian Reports, 1854-1883; U. S. Coast Survey, 1854-1869. Full particulars to enquirers. F. GARDINER, JR., Pomfret, Conn.

Wanted, in exchange for the following works, any standard works on Surgery and on Diseases of Children: Wilson's "American Ornithology," 3 vols.; Cques' "Birds of the Northwest" and "Birds of the Colorado Valley," 2 vols.; Minot's "Land and Game Birds of New England;" Samuels' "Our Northern and Eastern Birds;" all the Reports on the Birds of the Pacific R. R. Survey, bound in 2 vols., morocco; and a complete set of the Reports of the Arkansas Geological Survey. Please give editions and dates in corresponding. R. ELLSWORTH CALL, High School, Des Moines, Iowa.

To exchange Wright's "Ice Age in North America" and Le Conte's "Elements of Geology" (Copyright 1882) for "Darwinism," by A. R. Wallace, "Origin of Species," by Darwin, "Descent of Man," by Darwin, "Man's Place in Nature," Huxley, "Mental Evolution in Animals," by Romanes, "Pre-Adamites," by Winchell. No books wanted except latest editions, and books in good condition. C. S. Brown, Jr., Vanderbilt University, Nashville, Tenn.

Wants.

Any person seeking a position for which he is qualified by his scientific attainments, or any person seeking some one to fill a position of this character, be it that of a teacher of science, chemist, draughtsman, or what not, may have the 'Want' inserted under this head FREE OF COST, *if he satisfies the publisher of the suitable character of his application. Any person seeking information on any scientific question, the address of any scientific man, or who can in any way use this column for a purpose consonant with the nature of the paper, is cordially invited to do so.*

TRANSLATOR wanted to read German architectural works at sight (no writing). One familiar with technical terms desired. Address "A.," Box 149, New York Post Office.

WANTED.—A position in a manufacturing establishment by a manufacturing Chemist of inventive ability. Address M. W. B., care of *Science*, 874 Broadway, N. Y.

WANTED.—Books on Anatomy and Hypnotism. Will pay cash or give similar books in exchange. Also want medical battery and photo outfit. DR. ANDERSON, 182 State street, Chicago, Ill.

WANTED.—A college graduate with some normal training, to teach the sciences, at $1,800 per year, in a Southern college. A Baptist or a Methodist preferred. Must also be a first-class Latin scholar. A. H. Beals, Box K, Milledgeville, Ga.

A PROFESSORSHIP in Chemistry is wanted by one who has had five years' experience in that capacity. Would prefer to give instruction by lectures and experiments rather than by text-book methods. Would like a position in a college or university where there is a good student's laboratory. Special points of strength claimed are: (1) Thorough control of a class and good order during lectures and recitations. (2) Accuracy in experimenting with chemicals and skill in the manipulation of chemical apparatus. The permission of several distinguished educators has been given to refer to them if required. Would not care to accept a position paying less than $1,500. Address B. E., care of *Science*, 874 Broadway, New York.

ADDRESS WANTED.—Will some one please send the address of the Secretary of the American Philological Society. Also that of Herbert Spencer. "ADDISON," Room 84, 164 Madison St., Chicago, Ill.

ADDRESSES of Old Book Dealers wanted.—Wishing to obtain a number of old books out of print, I very much desire the addresses or catalogues of rare second-hand book dealers. If there is a directory or list of such dealers I should like to obtain possession of one. W. A. BLAKELY, Chicago, Ill.

1871–1884; H. M. Inspectors of Explosives Reports, 1873–1885. Part II. continues the Index for the above periodicals up to 1891, and contains the following in addition: *Dingler's Polytechnisches Journal*, 1820–1890; Proceedings American Chemical Society, 1879–1890; *Nicholson's Journal*, 1797–1813; *Popular Science Monthly*, 1871–1890; *Edinburgh Journal of Science*, 1824–1832; *Brande's Journal of Science*, 1816–1830. This index has been made by a careful search of each page of each of the 984 volumes included in it and is believed to be complete from the date of first issue of each of the periodicals named. Subscriptions should be sent to Charles E. Munroe, Torpedo Station, Newport, Rhode Island, U.S.A.

— Lord Randolph Churchill's account of his African journeys and adventures is to be published immediately by D. Appleton & Co. in a lavishly illustrated volume, entitled "Men, Mines, and Animals in South Africa." The book contains picturesque and humorous descriptions of scenes in the diamond-mines and gold-fields, of hunting in Bechuanaland and life in Mashonaland, and adventures with lions and elephants are interspersed among many characteristic comments upon people, manners, and customs, and practical resources. The book contains a portrait of the author, sixty-five illustrations, and a map.

— An article of especial value to teachers in the May number of the *Atlantic Monthly* is by James J. Greenough of Cambridge, a successful teacher in one of the most famous of the secondary schools in New England, which fit boys for Harvard, entitled "The Present Requirements for Admission to Harvard University." In this paper the writer speaks of the faults of the old system of entrance examinations and gives the history of the growth of the present system. He describes clearly the kind of instruction which is required to meet such examinations, in which the college requires each student who is admitted not only to have a large amount of useful knowledge, but at the same time to know how to use this knowledge to the best advantage.

QUERY.

Can any reader of *Science* cite a case of lightning stroke in which the dissipation of a small conductor (one-sixteenth of an inch in diameter, say,) has failed to protect between two horizontal planes passing through its upper and lower ends respectively? Plenty of cases have been found which show that when the conductor is dissipated the building is not injured to the extent explained (for many of these see volumes of Philosophical Transactions at the time when lightning was attracting the attention of the Royal Society), but not an exception is yet known, although this query has been published far and wide among electricians.

First inserted June 19. No response to date.

N. D. C. HODGES,

874 BROADWAY, NEW YORK.

TO THE READERS OF SCIENCE.

PUBLISHER'S ANNOUNCEMENT.

OUR PLANS.

Within the past six months the use of *Science* by scientific men and women as a medium for prompt publication and weekly discussion, has increased very materially, so that the pages are now well filled each week with original matter. As the number of those promising contributions is increasing at the rate of three or four each day, it cannot be long before *Science* at its present size will be too small for the amount of matter offered. We have under consideration therefore an enlargement of the paper by one-half, but must first learn the temper of our constituency as to an advance in price to $5.00, which was the subscription price from the start for four years, up to June 30, 1887. Further, to carry out the proposed enlargement, we shall need five hundred additional subscribers. If you are not already a subscriber, are you willing to aid in making *Science* more worthy of American scientific work by becoming one?

It goes without saying, that the demand for scientific literature is limited, when compared with that for literature which is more to the public taste, so that the receipts of most of the Scientific Journals, in this country, do not pay quite for their printing and paper, to say nothing of the other items of expense. We say this merely to emphasize the fact, that generous and prompt support must be accorded this move if it is to succeed.

Titles of Some Articles Published in *Science* since Jan. 1, 1892.

Aboriginal North American Tea.
Actinism.
Amenhotep, King, the tomb of.
Anthropology, Current Notes on.
Arsenical Poisoning from Domestic Fabrics.
Anatomy, The Teaching of, to Advanced Medical Students.
Astronomical Notes.
Botanical Laboratory, A.
Brain, A Few Characteristics of the Avian.
Celts, The Question of the.
Collection of Objects Used in Worship.
Deaf, Higher Education of the.
Diphtheria, Tox-Albumin.
Etymology of two Iroquoian Compound Stems.
Eye-Habits.
Family Traits, Persistency of.
Fishes, The Distribution of.
Fossils, Notice of New Gigantic.
Grasses, Homoptera Injurious to.
"Healing, Divine."
Hemipterous Mouth, Structure of the.
Hypnotism among the Lower Animals.
Hypnotism, Traumatic.
Indian occupation of New York.
Influenza, Latest Details Concerning the Germs of.
Infant's Movements.
Inventors and Manufacturers, the American Association of.
Iowa Academy of Sciences.
Jargon, The Chinook.
Klamath Nation, Linguistics.
Lightning, The New Method of Protecting Buildings from.
Lissajou's Curves, Simple Apparatus for the Production of.
Maize Plant, Observations on the Growth and Chemical Composition of.
Mineral Discoveries, Some Recent, in the State of Washington.
Museums, The Support of.
Patent Office Building, The.
Pocket Gopher, Attempted Extermination of.
Psychological Laboratory in the University of Toronto.
Psychological Training, The Need of.
Rain-Making.
Rivers, Evolution of the Loup, in Nebraska.
Scientific Alliance, The.
Star, The New, in Auriga.
Storage of Storm-Waters on the Great Plains.
Teaching of Science.
Tiger, A New Sabre-Toothed, from Kansas.
Timber Trees of West Virginia.
Tracheæ of Insects, Structure of.
Vein-Formation, Valuable Experiments in.
Will, a Recent Analysis of.
Wind-Storms and Trees.
Wines, The Sophisticated French.
Zoology in the Public Schools of Washington, D. C.

Some of the Contributors to *Science* Since Jan. 1, 1892.

Aaron, Eugene M., Philadelphia, Pa.
Allen, Harrison, Philadelphia, Pa.
Baldwin, J. Mark, University of Toronto, Canada.
Barnes, Charles Reid, Madison, Wis.
Baur, G., Clark University, Worcester, Mass.
Beal, W. J., Agricultural College, Mich.
Beals, A. H., Milledgeville, Ga.
Beauchamp, W. M., Baldwinsville, N.Y.
Boas, Franz, Clark University, Worcester, Mass.
Bostwick, Arthur E., Montclair, N.J.
Bradley, Milton, Springfield, Mass.
Brinton, D. G., Philadelphia, Pa.
Chandler, H., Buffalo, N.Y.
Comstock, Theo. B., Tucson, Arizona.
Cragin, F. W., Colorado Springs, Col.
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Farrington, E. H., Agricultural Station, Champaign, Ill.
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Gallaudet, E. M., Kendall Green, Washington, D.C.
Garman, S., Museum of Comp. Zool., Cambridge, Mass.
Golden, Katherine E., Agricultural College, Lafayette, Ind.
Hale, Edwin M., Chicago, Ill.
Hale, George S., Boston, Mass.
Hale, Horatio, Clinton, Ontario, Canada.
Hall, T. Proctor, Clark University, Worcester, Mass.
Halsted, Byron D., Rutgers College, New Brunswick, N.J.
Haworth, Erasmus, Oskaloosa, Iowa.
Hay, O. P., Irvington, Ind.
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Hewitt, J. N. B., Bureau of Ethnology, Washington, D.C.
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Kellicott, D. S., State University, Columbus, O.
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Oliver, J. E., Cornell University, Ithaca, N.Y.
Osborn, Henry F., Columbia College, New York City.
Osborn, Herbert, Agricultural College, Ames, Iowa.
Pammel, L. H., Agricultural Station, Ames, Iowa.
Pillsbury, J. H., Smith College, Northampton, Mass.
Ruffner, W. H., Lexington, Va.
Schufeldt, R. W., Washington, D.C.
Scripture, E. W., Clark University, Worcester, Mass.
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Stevenson, S. Y., Philadelphia, Pa.
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Thurston, R. H., Cornell University, Ithaca, N.Y.
Todd, J. E., Tabor, Iowa.
True, Frederick W., National Museum, Washington, D.C.
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Ward, R. DeC., Harvard University, Cambridge, Mass.
Ward, Stanley M., Scranton, Pa.
Warder, Robert B., Howard University, Washington, D.C.
Welch, Wm. H., Johns Hopkins University, Baltimore. M.D.
West, Gerald M., Clark University, Worcester, Mass.
Williams, Edward H., Lehigh University, Bethlehem, Pa.

SCIENCE

A WEEKLY NEWSPAPER OF ALL THE ARTS AND SCIENCES.

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CONTENTS.

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SCIENCE

NEW YORK, MAY 20, 1892.

THE GROWTH OF CHILDREN.—II.

In No. 483 of *Science* I have tried to show that measurements of children of a given age are, as a rule, not distributed symmetrically around the average, but that they are distributed asymmetrically, the curve being expressed by the formula —

$$\frac{(1 + c\,u)}{M\sqrt{2\pi}} e^{-\frac{u^2}{2M^2}}.$$

In this expression c is a small constant, M the mean variation, and u the deviation from that measurement which belongs to the individual which will finally be an average individual in regard to the measurement under consideration and whose development corresponds exactly to that of its age. In this sense the measurement may be called that of the average individual, although it is not the average of all the measurements.

Supposing an extensive series of observations on children of a certain age to be given, the question arises, how to find that value which belongs to the average individual and how to find the mean variation. The number of observations between the limits a and b will be

$$\int_a^b \frac{(1 + c\,u)}{M\sqrt{2\pi}} e^{-\frac{u^2}{2M^2}} du = \int_{\frac{a}{M\sqrt{2}}}^{\frac{b}{M\sqrt{2}}} \frac{1}{\sqrt{\pi}} e^{-t^2} dt - \frac{c\,M}{\sqrt{2\pi}}\left(e^{-\frac{b^2}{2M^2}} - e^{-\frac{a^2}{2M^2}}\right)$$

Whenever a and b remain the same multiples of M, the value of this integral depends solely on $\frac{c\,M}{\sqrt{2\pi}}$ and a table of the values of the integral may be computed. It is convenient to assume $a = -\infty$ and to compute the integral. Following is a brief table of the integral:—

$$\int_{-\infty}^{\frac{b}{M\sqrt{2}}} \frac{1}{\sqrt{\pi}} e^{-t^2} dt - \frac{c\,M}{\sqrt{2\pi}} e^{-\frac{b^2}{2M^2}}$$

$$\frac{c\,u}{\sqrt{2\pi}}$$

b	−0.10	−0.08	−0.06	−0.04	−0.02	0.00	+0.02	+0.04	+0.06	+0.08	+0.10
$-3.0\,M$	0.0025	0.0023	0.0021	0.0018	0.0016	0.0014	0.0012	0.0010	0.0007	0.0005	0.0003
$-2.5\,M$	0.0106	0.0097	0.0088	0.0080	0.0071	0.0062	0.0053	0.0044	0.0036	0.0027	0.0018
$-2.0\,M$	0.0362	0.0335	0.0308	0.0281	0.0254	0.0227	0.0200	0.0173	0.0146	0.0119	0.0091
$-1.5\,M$	0.0990	0.0925	0.0860	0.0795	0.0731	0.0666	0.0601	0.0537	0.0472	0.0407	0.0342
$-1.0\,M$	0.2212	0 2091	0.1970	0.1849	0.1727	0.1606	0.1485	0.1363	0.1242	0.1121	0.1000
$-0.5\,M$	0.3967	0.3791	0.3614	0.3438	0.3261	0.3085	0.2909	0.2732	0.2556	0.2379	0.2203
$0.0\,M$	0.6000	0.5800	0.5600	0.5400	0.5200	0.5000	0.4800	0.4600	0.4400	0.4200	0.4000
$+0.5\,M$	0.7797	0.7621	0.7444	0.7268	0.7091	0.6915	0.6739	0.6562	0.6386	0.6209	0.6033
$+1.0\,M$	0.9000	0.8879	0.8758	0.8637	0.8515	0.8394	0.8273	0.8151	0.8030	0.7909	0.7788
$+1.5\,M$	0.9658	0.9593	0.9528	0 9463	0.9399	0.9334	0.9269	0.9205	0.9140	0.9075	0.9010
$+2.0\,M$	0.9908	0.9881	0.9854	0.9827	0.9800	0.9773	0.9746	0.9719	0.9692	0.9665	0.9637
$+2.5\,M$	0.9982	0.9973	0.9964	0.9956	0.9947	0.9938	0.9929	0.9920	0.9912	0.9903	0.9894
$+3.0\,M$	0.9997	0.9995	0.9993	0.9990	0.9988	0.9986	0.9984	0.9982	0.9979	0.9977	0.9975

The series of actual observations must correspond to one of these theoretical curves. We must find those values of c and M which agree most nearly with the curve of the observations. c and M may be determined from any two values of the integral. The most probable values will be those which are found by taking into consideration all the given values. This may be done in the following way: We will call the value for which $u = 0$, U; then, any observed value

$$Y = U + u.$$

The average of all observed values

$$A_1 = \int_{-\infty}^{+\infty} \frac{(U+u)\,(1+cu)}{M\sqrt{2\pi}} e^{-\frac{u^2}{2M^2}} du$$

(1) $$A_1 = U + c\,M^2$$

The average of the squares of all observed values

$$A_2 = \int_{-\infty}^{+\infty} \frac{(U+u)^2\,(1+cu)}{M\sqrt{2\pi}} e^{-\frac{u^2}{2M^2}} du$$

$$= U^2 + 2\,U c\,M^2 + M^2$$

$$A_2 = U^2 + 2\,U(A_1 - U) + M^2$$

(2) $$A_2 = -\,U^2 + 2\,U A_1 + M^2; \text{ and}$$

(3) $$U = A_1 \pm \sqrt{M^2 - (A_2 - A_1^2)}.$$

By substituting this value in (1) we find

(4) $$\frac{c\,M}{\sqrt{2\pi}} = \frac{\mp\sqrt{M^2 - (A_2 - A_1^2)}}{M\sqrt{2\pi}}$$

By computing the average of the observations and of their squares, we can, therefore, find easily a series of the three values U_1, M, c, and we have to select the one which gives the most satisfactory agreement between the theoretical curve and the actual curve, i.e., the one in which the sum of the squares of the differences between the two curves are a minimum. The actual computation becomes a little simpler by substituting

$Y = C + y$ where C is equal or nearly equal A_1.

The average of all y $\quad a_1 = U - C + c\,M^2 = 0$

The average of all y^2 $\quad a_2 = (U-C)^2 + 2\,(U-C)\,(A_1 - U) + M$

$$= (C - A_1)^2 - (U - A_1)^2 + M^2$$

$$U = A_1 \pm \sqrt{M^2 - a_2 + (C - A_1)^2}.$$

I will show the application of this method by computing the stature of 12-year-old girls, measured in Worcester, Mass., 1891. 112 observations are available.

$$A_1 = 1446.6;\quad C = 1447;\quad a_2 = 5365.$$

$$U = 1446.6 \pm \sqrt{M^2 - 5364.84.}$$

We assume various values for M, and find the corresponding values for U and $\frac{c\,M}{\sqrt{2\pi}}$.

M	U	$\frac{c\,M}{\sqrt{2\pi}}$
73.8	1455.6	− 0.049
74.0	1457.1	− 0.057
74.2	1458.5	− 0.064
74.4	1459.7	− 0.070

Then the number of cases which are required by the theory may be found from the above table, while the observed number of cases are found by computing $U - 3\,M$, $U - 2.5\,M$, etc., and counting the number of cases below these points. By this process we find the following results: —

	$M = 73.8$.			$M = 74.0$.			$M = 74.2$			$M = 74.4$.		
	Observation.	Theory.	△	Observation.	Theory.	△	Observation.	Theory.	△	Observation.	Theory.	△
$U - 3.0\,M$	0.0	0.2	– 0.2	0.0	0.2	– 0.2	0.0	0.2	– 0.2	0.0	0.2	– 0.2
$U - 2.5\,M$	0.0	0.8	– 0.8	0.0	0.9	– 0.9	0.0	0.9	– 0.9	0.0	0.9	– 0.9
$U - 2.0\,M$	0.9	2.9	– 2.0	1.8	3.0	– 1.2	1.8	3.1	– 1.3	1.8	3.2	– 1.4
$U - 1.5\,M$	6.4	8.2	– 1.8	7.3	8.5	– 1.2	8.2	8.7	– 0.5	9.0	8.9	+ 0.1
$U - 1.0\,M$	18.9	18.9	– 0.0	19.8	19.5	+ 0.3	19.8	20.0	– 0.2	19.8	20.3	– 0.5
$U - 0.5\,M$	36.7	35.2	+ 1.5	37.5	36.0	+ 1.5	40.2	36.5	+ 3.7	41.1	37.0	+ 4.1
U	59.0	53.9	+ 5.1	59.0	55.7	+ 3.3	59.0	56.4	+ 2.6	59.0	57.0	+ 2.0
$U + 0.5\,M$	76.8	72.6	+ 4.2	76.8	74.0	+ 2.8	76.8	74.8	+ 2.0	76.8	75.3	+ 1.5
$U + 1.0\,M$	84.0	86.3	– 2.3	85.0	87.3	– 2.3	85.9	87.8	– 1.9	85.9	88.2	– 2.3
$U + 1.5\,M$	92.9	94.6	– 1.7	92.9	95.1	– 2.2	92.9	95.4	– 2.5	92.9	95.6	– 2.7
$U + 2.0\,M$	99.1	98.3	+ 0.8	99.1	98.5	+ 0.6	99.1	98.6	+ 0.5	99.1	98.7	+ 0.4
$U + 2.5\,M$	99.1	99.6	– 0.5	99.1	99.6	– 0.5	99.1	99.7	– 0.6	99.1	99.7	– 0.6
$U + 3.0\,M$	100.0	99.9	– 0.1	100.0	99.9	+ 0.1	100.0	99.9	+ 0.1	100.0	99.9	+ 0.1
$\Sigma \triangle^2$			62.90			35.55			37.76			39.24

We find, therefore, the following series of values corresponding best to the series of observations: —

$$M = 74.0; \quad U = 1457.1; \quad \frac{c\,M}{\sqrt{2\,\pi}} = -\,0.057.$$

It is clear that this method gives the more satisfactory results the greater the number of observations. If the number of observations is small, a slight change in the value of M may change any single value so much, that the regularity of the series $\Sigma \triangle^2$ is so much affected that the point where this sum becomes a minimum cannot be determined very accurately, although it may be possible to find it very nearly by assuming a sufficiently long series of M on both sides of the probable value and applying graphical methods for finding the minimum. The differences between the average of all statures and the stature of the average child of a certain age is quite considerable. I have computed these values for the ages of 11, 12, and 13 years, of girls.

Girls:	11 years.	Stature,	Average:	1370.0	$U = 1386.9$	$\triangle = +\,16.9$
"	12 "	"	"	1446.6	1457.1	+ 10.5
"	13 "	"	"	1494.2	1506.5	+ 12.3

As might have been expected, the statures during a period when the rate of growth is decreasing, are higher than the averages of all statures. This difference will continue until the adult stage is reached. It becomes also probable that the average individual does not grow as long as the tables of averages seem to indicate.

Franz Boas.

Clark University, Worcester, Mass., April 25.

THE BROOKLYN INSTITUTE AND POLITICAL SCIENCE.

The Brooklyn Institute of Arts and Sciences is an institution that has earned a national reputation for its unique and successful educational work. Founded in 1824, it began five or six years ago, under the direction of Professor Franklin W. Hooper, a career of greatly increased usefulness and influence. To-day it has nineteen hundred subscribing members, organized in twenty-five departments of work, a property valued at $250,000, and an annual income from membership fees of upward of $11,000.

The membership of the institute, while it includes a considerable number of distinguished specialists in the various departments, is largely made up of people of general culture, and of young men and women who, without being able to continue their studies in college, are intelligent and thoughtful, and interested in one or more departments of study. The largest and, considering the standing of its members in the community, the most influential of all the departments of the institute is that of political and economic science, organized in December, 1889, with Professor Richmond Mayo-Smith, the specialist in statistical science of Columbia College, as its first president.

This department has already done a most excellent work in Brooklyn, in its department meetings, its courses of lectures upon subjects in political science, and in the addresses of distinguished speakers, given under its auspices, upon occasions of wide popular interest. It is largely to the stimulating influence of this work during the last three years, that the proposition, recently made to the department, to establish a school of political science, is due. Excellent as the lectures and anniversary meetings of the department have been, the members now demand something more systematic and specialized.

The plan proposed contemplates the ultimate establishment of a fully equipped school of political science with elementary and advanced courses in civil government, political economy, social science, and history, at nominal rates for tuition. The proposition to establish such a school was enthusiastically received at the recent annual meeting of the department; the only question now is as to the proper ways and means for putting the plan into practice.

It is evident that there are grave difficulties in the way of the successful carrying out of such a project. The lack of uniformity in the acquirements of the membership of the institute, and the influences tending to interfere with a faithful attendance upon courses once begun are not so great obstacles as the difficulty of finding instructors with the qualifications requisite for this particular work. The executive committee of the department, to whom the whole matter was entrusted with power to act according to their judgment in the matter, will not be likely to move hastily. Should sufficient encouragement be offered in the way of a moderate endowment, the school may be opened in the fall, and courses in some of the above mentioned subjects offered for 1892–93.

PREPARATION FOR THE STUDY OF MEDICINE.[1]

Incomplete is a discussion of this subject that does not include a consideration of the great value of an elementary knowledge of Latin and Greek.

I here most seriously disclaim any attempt to prove that devotion to Latin and Greek for the purpose of reading the literature of these languages is either requisite or even desirable as a preparation for the study of medicine. The field of modern literature and of modern science has become so vast and important that the average student will find neither time nor relative profit in the attempt to *master* the ancient classics.

I do, however, earnestly advocate the study of the rudiments — I mean simply the rudiments — of Latin and Greek, as most valuable labor-saving instruments in acquiring an English, a scientific and a medical education.

I ask indulgence, if I dwell somewhat at length on this portion of my subject, for I think we are in danger of losing sight of the many and great benefits, which every true student will receive from a judicious study of some things in

[1] Address of President E. L. Holmes Rusk, Medical College, Chicago.

these living dead languages. My argument turns on the word judicious — as applied to the extent and method of the study. The old methods, as unphilosophical as they well could be, and the undue time and labor devoted to the classics are worthy of radical change in the modern system of education.

Consider the vast array of technical terms and of common English words in our general and scientific literature, which are also pure Latin and Greek words. Look at this remarkable series of paradoxes! A young man may never have learned a single word of Latin or Greek, and yet under ordinary circumstances he has learned by hearing and reading English several hundred Latin and Greek words — if he is especially intelligent, at least three thousand. When he receives his degree of Doctor of Medicine, he has learned by the most painful toil several hundred technical terms taken from these languages — and still does not know a single word of Latin or Greek. He can count in Latin and Greek and yet is in ignorant bliss of the fact, for he could not give on demand a single numeral of these languages. He already knows the names of several colors, of several of the elements, and yet cannot tell one of them. He knows the Latin and Greek names of every member of the body, of every organ, tissue, fibre and fluid and of all their diseases, of all the senses and functions, and the words to express writing, describing and measuring. If, however, he was asked to give the Latin and Greek synonyms for any of them he could not give it.

Now for the pith of what I have to say! A rudimentary Latin, as also a Greek, grammar with the readers should be constructed for the primary object of teaching English — secondarily of teaching Latin and Greek.

The Latin grammar, save perhaps fifty connectives and other important words should contain scarcely forty pages of declensions and conjugations with only a very few rules. Every word of this grammar should be a good English word with possibly a slight change of a letter or syllable.

The Latin reader should contain at least a hundred and fifty pages of pure, even elegant Latin from classic prose and from poetry, almost every word of which would be a good English word.

We will present a few examples:

"Labor omnia vincit."

"Poeta nascitur, non fit."

"facilis descensus Averno:
Noctes atquedies patet atri janua Ditis
Sed revocare gradum superasque evadere ad auras.
Hoc opus, hic labor est."

Literae adulescentiam alunt, senectutem oblectant secundas res ornant, adversis perfugium ac solatium praebent, delectant domi, non impediunt foris, pernoctant nobiscum, peregrinantur, rusticantur."

"Homo sum, humani nihil a me alienum puto."

"Pallida Mors aequo pulsat pede pauperum taburnas Regumque turres."

These of course could be preceded by many simpler sentences, such as "Tempus fugit." "Res sacra est miser."

As the multiplication table must be committed to memory before the child can progress in arithmetic, so the few pages of declensions and conjugations must be memorized, that the beginner may become perfectly familiar with Latin terminations. With this preliminary exercise the scholar would then find no perplexities and would read almost at sight all the sentences in the reader.

In the vocabulary at the end of the reader with every principal word should be arranged all cognate words. With the definition of each word should be presented all English words derived from it.

Instead of exercises in transposing English into Latin, I would for the first year direct the energies of the pupil in the discipline of memorizing by easy tasks the classic sentences I have just described.

There seems to be a growing prejudice among educators of recent times against the practice of "learning by heart." I am convinced there is no way by which one can make more rapid progress in learning a language, either ancient or modern, than by committing to memory wisely selected sentences and phrases.

This is the natural method of learning a language. The child, from the time it attempts to utter its first syllable, never speaks that syllable perfectly till it has learned it by heart. In a single year the pupil will learn far more Latin than in two or three years by the methods usually pursued in our public schools.

The same plan should be pursued in teaching the elements of Greek. Thirty pages of grammar, each word of which should be an English word, except fifty connectives and other important words, would suffice.

There would be some difficulty in filling a Greek reader with gems of Greek, which would also be English. A competent Greek scholar, however, with the aid of fifty connective words not English, could compile a few such sentences and paraphrase others. He could arrange simple narrative of facts from history, biography, geography and mythology, in which the several hundred Greek words in our language could be formed into quite long sentences and convey much useful information.

Pardon me for reading a dry list of familiar syllables to call to your minds a multitude of Greek English words which, properly arranged, would fill many pages of instructive reading — words ending in graph, gram, meter, logue, asm, scope, sis; words commencing with dia, a or an, kata, para, apo, hypo, hyper, hydro, phos, sym or syn, phil, peri, tech, tel; words in which the following are important syllables, hepat, soma, stoma, ptoma, tony, pneuma, deme, crat, arch, bion, phon, tone, sarc.

There is a great need of such elementary text-books for the use of professional students, the preparation of which is worthy the attention of any ingenious and thorough Latin and Greek scholar. As far as I am aware, those which have been heretofore arranged do not possess vocabularies sufficiently extensive for the use of the medical student in studying technical terms. The portion devoted to grammatical forms is also inadequate. Moreover, the quotations and other sentences are not selected with reference to their elegance of expression and beauty of sentiment, which render them suitable for memorizing. Nor do they seem to be selected with special reference to the useful knowledge they convey.

The vocabulary should be sufficiently extensive to present not only all words used in our general literature, but also in the sciences. The following examples will illustrate my meaning: —

Tango, tangere, tetigi, tactum (contingo, contingere, contigi) = To touch. Tactus = Sense of touch. Tangent, tangible, intangible, tact, intact, contact, contiguous, contiguity, contingent, contingency (integer, integral ?).

σαρκαξω = To tear flesh like dogs. Sarcasm, sarcastic.
σαρκιξω = To play. Sarcousa, sarcosis.
σαρκικος = Fleshy. Sarcous, sarcocele.

σαρκοφαγος = Flesh consuming. Anasarca.
σαρξ-κος = Flesh. Sarcophagus.
"κακων πε λαγος"
κακος = Bad, evil. Cacodyle — cachectic, cacexy — cacoethes, cacophony.
πελαγος = The Sea. Archipelago.

After this study of English, Latin, and Greek, the student can understand without difficulty the technical terms of every science in every modern language. He is also able to trace the derivation and meaning of new terms which are constantly formed in every department of knowledge.

He possesses the key by which he can acquire two modern languages in the time otherwise required for one; he enjoys a deeper insight into the spirit of all literature; he has a systematic knowledge of sufficient Latin and Greek to enable him to continue alone his reading of the classics if he has the time and taste so to do; he has increased and perfected the vocabulary of his own language, which, in very great degree, is a measure of mental development, and which possesses an intrinsic value almost beyond estimation.

This course is relatively easy, since the pupil makes use, through every step, of a large vocabulary which he has in great measure already at his command. After he has once learned the inflections, he makes rapid progress in comprehending the simpler forms of construction. He soon recognizes at a glance important "stems" in English words, even when they are disguised, as in microbe and autobiography, in telescope and episcopal, and in chylopoetic and poetry.

A vast majority of pupils in our high schools drop their studies at the end of their second year. They have spent so much time in struggling with an absolutely strange vocabulary and idioms that they have learned very little English and still less Latin and Greek. By the plan here advocated, they will have made progress in their own language and acquired considerable knowledge in the ancient languages — an excellent foundation for further study in any field. They will have stored their minds with many beautiful sentences, epigrams, mottoes, and gems of thought.

This course will not materially conflict with any method which a teacher may prefer.

NOTES AND NEWS.

At a meeting of the Botanical Club of Washington, held April 23, 1892, a committee was appointed to consider and report upon the questions of a botanical congress and botanical nomenclature. At a special meeting, called May 7, this committee presented a report, which was unanimously adopted by the Club, to the effect, that, while favoring the final settlement of disputed questions by means of an international congress, they do not regard the present as an opportune time, but that they recommend the reference of the question of plant nomenclature, first, to a representative body of American botanists; they suggest the consideration, by such a body, of the following questions, among others: The law of priority, An initial date for genera, An initial date for species, The principle "once a synonym always a synonym," What constitutes publication? The form of ordinal and tribal names, The method of citing authorities, Capitalization; that they recognize the Botanical Club of the A. A. A. S. as a representative body of American botanists, and commend to that body, for discussion and disposal, the subject of nomenclature as set forth in these resolutions. The report was signed by Lester F. Ward, Geo. Vasey, F. H. Knowlton, B. T. Galloway, Erwin F. Smith, Geo. B. Sudworth, Frederick V. Coville.

—M. Faure has recently invented a process of producing aluminium, according to *Engineering*, by means of which he hopes to reduce its price to about 8d. or 9d. a pound. Briefly speaking, his proposed method consists in obtaining, in a cheap manner, aluminium chloride and decomposing it electrically. This decomposition can be effected with a smaller potential difference than can that of the fluoride most frequently used for preparing aluminium by electrolysis, and at the same time a valuable bye-product is formed in the chlorine liberated. It is said, however, that there are considerable difficulties in the way of making the proposed process a commercial success.

— Opinions are being expressed by scientific workers in India, says *Nature*, in favor of the making of systematic experiments with snake poison. The Committee for the Management of the Calcutta Zoological Gardens are constructing, from private subscriptions a snake-house with the most modern improvements, which will contain specimens of all the principal poisonous snakes in the country. If the necessary funds were available, arrangements could be made to fit up a small laboratory in connection with the snake-house, for the purpose of conducting inquiries of all descriptions bearing upon the pathology of snake-bite and cognate subjects, and in future there would be no difficulty in arranging for the carrying out of any special experiments that might be required. It is understood that Dr. D. D. Cunningham, F.R.S., President of the Committee, would in that case be willing to take an active part in organizing and promoting such inquiries and carrying out such experiments, including the testing of the various alleged remedies for snake-bite, which are from time to time brought to notice.

— Captain Bower of the Indian Staff Corps has arrived at Simla from China, after a very remarkable journey across the Thibet Tableland, according to *Nature*. He had with him Dr. Thorold, a sub-surveyor, one Pathan orderly, a Hindoostani cook, six caravan drivers, and forty-seven ponies and mules. The Calcutta correspondent of the *Times*, who gives an account of the journey, says that Captain Bower, leaving Leh on June 14, crossed the Lanakma Pass on July 3, avoiding the Thibetan outpost placed further south. Journeying due east, he passed a chain of salt lakes, one of which, called Hor-Ba-Too, is probably the highest lake in the world, being 17,930 feet above the sea. Gradually working to the south-east, the explorer saw to the north a magnificent snowy range, with a lofty peak in longitude 83° and latitude 35°. After many weeks' travel over uplands exceeding 15,000 feet in height, where water was scarce and no inhabitants were to be seen, the party on Sept. 3 reached Gya-Kin-Linchin, on the northern shore of Tengri Nor Lake, in longitude 91° and latitude 31°. This is within a few marches of Lhassa, and two officials from the Devi Jong, or temporal governor of Lhassa, met him here and peremptorily ordered him to go back. But he refused to return, and a compromise was effected, guides and ponies being provided on his agreeing to make a detour to the north in order to reach the frontier of Western China. He reached Chiamdo on Dec. 31, only just succeeding in getting off the tableland before winter set in. He struck Bonvalot's route for a few miles when marching to Chiamdo. The country about this town is very fertile and well wooded. Three thousand of the monks of Chiamdo, who lived in fine monasteries, threatened to attack the party, but were deterred on learning that they carried breechloaders. Captain Bower arrived at Tarchindo, an outpost on the Chinese frontier, on Feb. 10. The distance covered from Lanakma to Tarchindo was over 2,000 miles, all of which, save a few miles, has now been explored for the first time. The route for thirteen consecutive days lay over a tableland 17,000 feet high. Captain Bower is engaged in writing a report and completing his maps.

— "Of late years a considerable, and perhaps a disproportionate, amount of attention," says *Lancet*, "has been devoted to the scientific explanation of the state of unconsciousness. The public, as well as the professional, mind has been treated *ad nauseam* to discussions on hypnotism. The relations of trance and sleep to each other and to various phases of disease have elicited their share of logical ingenuity and of research. Quite recently again an allied condition — that of the numbed sensation consequent upon shock, such as that experienced in falling from a height — has attracted attention, though, beyond the assurances of some who have survived this experience that dread and pain are alike absent, we have no certain proof of the existence or the essential character of this merciful torpor. According to Professor Heim of Zurich, who has devoted much time and thought to the investigation of the subject, the sensations at such a time of the sufferer, if so he can be termed, resemble somewhat those of drowning persons. In place of pain there is a process of rapid and involuntary mental activity, succeeded by stupor; series of old memories fly past the mind like scenes in some rapid vision, and life is revised, as it were, on the threshold of death. One is naturally tempted to inquire what is the explanation of this extraordinary state, in which the final catastrophe appears to be lost in the dream-slumber preceding it. The preoccupation of rapid cerebration, a species of shock in itself, might furnish a clue to the mystery — at all events, as regards the abolition of pain and fear. We cannot help thinking, however, that other causes must be operating along with this, which at first presents itself as the most obvious. The analogy afforded by drowning is, to our mind, especially suggestive. We may remark that here we have to do with a highly probable alterative of normal brain function in the stimulant-sedative influence of a disturbed circulation. The advent of asphyxia implies the turgescence of all venous channels and capillaries, and the increasing accumulation in these of carbonic acid. It appears to us that the same process must occur in falling. As a rule the fall takes place with head downwards. At the same time there is exerted upon the respiratory passages the suction force of the outer air in rapid transit, acting, we may conclude, in much the same manner as water in a large tube, which draws into its own volume the fluid contents of any small communicating channel. Thus it would seem at least a reasonable hypothesis that the coma of death in the circumstances referred to, like the same condition in various forms of disease, is essentially a process of deoxidation of tissue with accumulation of carbonic acid."

— A preliminary paper "On Drift or Pleistocene Formations of New Jersey," by Professor R. D. Salisbury, has been issued by the Geological Survey of that State. The detailed survey of the Pleistocene (drift) formations of New Jersey was begun about the first of July of last summer. It is the purpose of this survey to prepare maps which shall represent the distribution and the relation of the various types of drift formed by the ice, and by the waters emanating from it, during the glacial or Pleistocene period. It is also the purpose of the survey to prepare maps showing the distribution and relations of such other formations as shall be found to exist within the State, which were made contemporaneously with the drift, or during any part of the Pleistocene period. With each sectional map of the Pleistocene formations it is proposed to publish a descriptive text, explaining and describing the nature of the various formations mapped, the method by which they originated, their relations to each other and to underlying formations, and the notable changes which they have undergone since their formation. Along with such descriptions, which will be adequate to the understanding of the maps, and of the surface formations of the areas represented on the maps, there may be suggestions concerning the economic significance of the formations. Obligations contracted before this work was undertaken have limited the time which has thus far been devoted to it. Of the two months spent in the field, a considerable part was given to a general reconnoissance of that part of the drift-bearing area adjacent to the terminal moraine. Some of the general results of this reconnoissance are embodied in the report. In addition to the work of reconnoissance, the detailed study and mapping of the surface formations has been begun, and has covered that part of Middlesex County, which lies north of the Raritan, most of Union County, and the south-eastern portion of Essex County. Under the circumstances it was deemed advisable to make this report no more than a general discussion of the drift and of the Pleistocene formations in general, with especial reference to the phenomena in New Jersey. This report may therefore be regarded as in some sense a preface to the more detailed reports which will follow when the work which must form their basis is completed.

—The eighth annual meeting of the Conference of State Boards of Health will be held in Lansing, Mich , June 6, 1892. The meeting will convene at 10 A.M., in the Senate Chamber of the State Capitol. Governor Winans will informally receive the members of the Conference in the Executive Rooms in the State Capitol during the day or evening of June 6. The local committee has expressed the hope that the time of the members of the Conference will permit of their visiting the three other State institutions located at Lansing. Headquarters will be at the Hotel Downey, where special rates have been secured. The following questions for the consideration of the Conference have been received by the Secretary: Proposed by the State Board of Health of Connecticut, (*a*) What is the most practicable way of providing a hospital for contagious diseases for a town or community of a population of 5,000, the same to be always ready for the reception of patients? (*b*) What will be the average cost of maintaining it, per annum; the probable number of patients it would be called upon to receive being regarded in the estimate? Discussion opened by Dr. L. F. Salomon of New Orleans, La., and Dr. Louis Balch, Albany, N. Y. Proposed by the State Board of Health of Indiana, How strict should the quarantine be in cases of diphtheria and scarlet-fever ? Discussion opened by Dr. Thos. J. Dills, Ft. Wayne, Ind., and a member of the Iowa Board of Health. The Michigan Plan of Sanitary Conventions, by Professor Delos Fall, Albion, Mich. Proposed by the State Board of Health of Louisiana, (*a*) What should be the relations of State and County Boards of Health? (*b*) What should be the relation of State Boards of Health to National Authorities? (c) What should be the relation of State Boards of Health to the State? Discussion opened by Dr. C. P. Wilkinson, New Orleans, La. Proposed by the State Board of Health of Pennsylvania, In view of the increasing frequency of communication between the Republic of Mexico and the United States, and of the constant prevalence of typhus fever in the former country, is there such probability of the introduction of that disease into the United States as to make it important for health officers along the southern frontier to use especial vigilance on that account? Discussion opened by Dr. Robert Rutherford, Houston, Tex., and Dr. L. F. Salomon, New Orleans, La. Proposed by the State Board of Health of Ohio, What measures can be enforced to prevent the spread of infectious diseases in rural districts? Discussion opened by Dr. J. T. Reeve, Appleton, Wis., and Dr. J. Berrien Lindsley, Nashville, Tenn. The relation of the Laboratory of Hygiene to the work of the State Board of Health, by Professor Victor C. Vaughan, Director of the State Laboratory of Hygiene, Ann Arbor, Mich. Proposed by the State Board of Health of Kentucky, Should State Boards of Health be charged with the administration of medical practice laws? Discussion opened by Dr. Henry B. Baker, Lansing, Mich., and Dr. Jerome Cochran, Montgomery, Ala. Proposed by the Provincial Board of Health of Ontario, (*a*) Has intra-State, inter-State, and International action to prevent the sewage pollution of streams become a necessity? (*b*) If so, what steps are practicable for bringing about conjoint action ? (c) What practical methods are available for preventing such pollution? Discussion opened by Dr. Benjamin Lee, Philadelphia, Pa., and Dr. P. H. Bryce, Toronto, Ont. The public health work in Michigan, by Dr. Henry B. Baker, Secretary of State Board of Health, Lansing, Mich. Proposed by the State Board of Health of Tennessee, The practical working of inter-State notification. Discussion opened by Dr. P. H. Bryce, Toronto, Ont., and Dr. J. Berrien Lindsley, Nashville, Tenn. Proposed by the State Board of Health of Vermont, The part played in the spread of tuberculosis by the flesh and milk of tuberculous cattle. Discussion opened by Dr. C. H. Fischer, Providence, R. I., and Dr. Victor C. Vaughan, Ann Arbor, Mich. Proposed by the State Board of Health of Pennsylvania, Is the disinfection of baggage essential to effective quarantine? Discussion opened by Dr. C. H. Hewitt, Red Wing, Minn., and Dr. S. R. Olliphant, New Orleans, La. The "unfinished business" includes, report of the committee to formulate a plan for the creation and organization of county and other local Boards of Health, report of the committee to make a Codification of the Health Laws of the different States and Provinces, report of the committee on the Collective Investigation of Diseases, report of the committee on Vital Statistics, report of the committee on the Prevention of Consumption, report of the committee on the Pollution of Streams, and the Formation of River-Conservancy Commissions.

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CURRENT NOTES ON ANTHROPOLOGY. — VI.

[*Edited by D. G. Brinton, M.D., LL.D.*]

Proto-Historic Ethnology of Asia Minor.

A BEAUTIFUL book, just published in London, Perrot and Chipiez's "History of Art in Phrygia, Lydia, Caria, and Lycia," sums up in an attractive manner the authors' opinions about the ethnology of Asia Minor at the dawn of history. They recognize that the evidence all points to the western origin of the Aryan peoples then dwelling there. The Phrygians, Mysians, Bithynians, Lydians, Carians, Lycians, and Armenians, all spoke languages and dialects belonging to the Aryan stock, and all can be traced back to their ancient seats in Thrace. Of these, the Lycians, whose tongue presents marked analogies to Zend and Sanscrit, were probably the first to cross the Hellespont.

This great Hellenic migration doubtless occupied centuries. It was approximately coincident with two famous events in the history of the country — the fall of the powerful Hittite kingdom, and the Trojan war; in other words, it occurred about twelve hundred years before the Christian era. The Hittites fell beneath the attacks of these Greek invaders and the forces of Ramses III. of the nineteenth dynasty. A number of them took refuge in Cyprus, as it is just at this time that the Hittite influence on Cypriote art becomes visible. Though Perrot and Chipiez do not call attention to this latter fact, it is attested by recent excavations (reported in the *American Journal of Archæology*, Sept., 1891).

A materially different sketch of the subject is that laid before the Anthropological Society of Vienna in January last by Professor W. Tomaschek. He grants that the Phrygians, Armenians, Mæonians, Skaians, and Cabali were of Aryan blood and European origin; but he denies both of these traits for the Carians, Lykaonians, Pisidians, and Lycians. All these and many smaller tribes he would group into a widespread, isolated linguistic stock, along with the Leleges of the Grecian peninsula. Its easternmost branch were the Tiburani, who lived on the western slope of the Cilician Amanus, and whom he identifies with the Tabala of the Assyrian inscriptions and the Tubal of the Book of Genesis. The Alarodi of Lake Van were another member.

Physically, this stock was short and brachycephalic, and succumbed easily to Aryan and Semitic inroads. Fragments of its language can still be collected from the current dialects of Asia Minor, especially in Cappadocia; for instance, six, *lingir;* seven *tůtli;* eight, *můtli;* nine, *danjar* or *tsankar;* woman, *lada;* child, *öne;* daughter, *zzemaza;* son, *tedäeme;* etc. These words show no affinity with any other tongue. The frequent locative terminations *assus*, *essus*, and *anda*, occurring throughout Greece and Asia Minor, belong to this ancient speech, and serve to define its limits.

The culture of its members was by no means savage, as the Cyclopean walls of Hellas were Lelegian structures, and the names and worship of Apollo, Artemis, and other Grecian deities were derived from the same source. So, at least, is Professor Tomaschek's opinion, whose article is printed in the last issue of the "Mittheilungen" of the society referred to.

Ethnography of India.

Dr. Emil Schmidt is docent of anthropology in Leipzig and author of an excellent text-book, "Anthropologische Methoden." In recent numbers of the *Globus* he has given briefly the results of some of his studies on the physical characteristics of the natives of India. The article is illustrated from his own photographs and presents some highly interesting types.

Dr. Schmidt does not quite agree with the observations of Mr. Risley, to which I have alluded in *Science*, April 8. His own classification of the native types is as follows: —

1. Narrow nosed, fair skinned.
2. Broad nosed, fair skinned.
3. Narrow nosed, dark skinned.
4. Broad nosed, dark skinned.

No. 2 he acknowledges is merely a mixed type, resulting from intermarriage of the white Aryan with the Dravidian stock. The real contention comes on No. 3, the narrow nosed, dark skinned type. An example of these are the Klings, day-laborers, constantly seen in the commercial cities of the Straits and the neighboring islands. They are considered of Telugu or Tamil origin, but have fine and regular features, symmetrical bodies and superior beauty; yet their color withal is often that of the darkest shades of the scale. They have been considered of mixed descent, but against this theory their hue and the fixity of the type seem to militate.

In conclusion, Dr. Schmidt expresses himself as opposed to designating the two ground-forms of Indian ethnic types by the terms "Aryan" and "Dravidian;" because these are rather linguistic than ethnographic designations. Better, he thinks, refer to them as light and dark, platyrhinic and leptorhinic types.

The Identity of Primitive Art-Motives.

It would be well worth while for those who seek to establish ethnic affiliations or prehistoric connections between nations, on the basis of the identity of their art and decorative designs, to peruse carefully the little work of Professor Alois Raimund Hein of Vienna, "Mäander, Kreuze, Hakenkreuze, und Urmotivische Wirbelornamente in Amerika" (Wien, Alfred Holder). It is the result of nearly a score of years' study of stylistic ornament and the development of design.

In this essay the author has confined himself to art-motives found among the native tribes of America, numerous examples of which he analyzes with a master hand. He reaches the conclusion, which I am convinced can never be overthrown, that the original and primitive expressions of the artistic sentiment reveal themselves everywhere in a series of motives which display a surprising and almost complete similarity. This practical identity continues high up in the evolution of art-forms. It is not to be attributed to any historic connection between nations, nor to any prehistoric relations or instruction, but solely to the unity of mind and its expressions through all humanity. "Thousands of ethnographic, religious, symbolic and artistic parallels, with which ethnography and archæology are making us familiar, are easily explained by the organic faculties of the mind of man. This is true for all zones and for all lands of the earth where man has slowly developed from simple to complex artistic conditions." Were these maxims fully understood, we should have fewer attempts to trace Greek and Assyrian back to Egyptian, or Central American back to Asiatic art, than has of late been the case.

Native Fairs in Alaska.

The early conveyance of articles of Asiatic manufacture far into America is matter of surprise for no one who is acquainted with the commercial and migratory habits of the natives of the Northwest Coast. As slaves are part of their stock in trade, Asian blood and features were introduced without a general or even partial migration of Siberic tribes across Behring Straits, for which, *du reste*, there is no evidence at all.

The times and places of these fairs were recenty stated by Mr. I. Horner from information supplied by Lieut. Miles C. Gorgas, U.S.N., in an address to the Numismatic and Antiquarian Society of Philadelphia, as follows: Beginning at the south, a fair is held in June at Port Clarence, just south of the narrowest part of the Straits. It is numerously attended by the Chukchis of Siberia, the natives of St. Lawrence Island, south of the Straits, and by others from Cape Prince of Wales on the American mainland. The second fair is held at Wotham Inlet on the north shore of Kotzebue Sound. It lasts through July and August, and is attended by about 1,500 people, some Siberians, but mostly natives, especially from Point Hope, these being the principal traders of the coast. A third fair is at Point Lay, and a fourth at Camden Bay, not far from the mouth of the Mackenzie River.

The trading boats make a regular round of these fairs, carrying articles in demand from one to the other; so that some from the far interior of Asia will in a few years be transported along the shores of the Arctic Sea, and southerly indefinitely into the centre of the continent. This has doubtless been going on for centuries, and would explain the presence even of Japanese and Chinese articles in ancient burial places — if such were ever found.

NOTES ON LOCAL JASSIDÆ.

AN interesting feature in the study of entomology is the fact that there are still a great many untrodden paths and plenty of work for the discovery of new species. In the Hemiptera there are still many forms unknown to science. In my collection of two or three seasons Professor Edward P. Van Duzee has found several new species; but only those belonging to the *Jassidœ* will be noticed here.

In his admirable paper on the genus *Phlepsius*, recently published by the American Entomological Society of Philadelphia, he enumerates several new species, and groups others under that genus, which to many have been known under other names; for instance, what we have known as *Bythoscopus strobi* Fitch is now to be known as *Phlepsius strobi* Fitch. This decision was rendered by Professor Van Duzee in 1890, and published in *Psyche.*

Our old and well-known species *Jassus irroratus* Say is now to be known as *Phlepsius irroratus* Say; it was at one time known as *Allygus irroratus* Uhler; and Burmeister, Walker, and Uhler knew it as *Jassus testudinarius* Burm.

The genus *Phlepsius* as now arranged by Professor Van Duzee is a step in the right direction, and his "synoptical table" of the species will be a great help to Hemipterists in studying this order of insects; it bespeaks a future for it and a basis for study equal to that projected by our able fellow-townsman, Professor Ezra T. Cresson, in the Hymenoptera.

The species in the Jassidæ taken by me in the locality of New York City number eighteen or more, some of which have as yet not been determined.

Phlepsius strobi is, according to our record, quite a rare species. Professor Van Duzee records but five specimens. Mr. Uhler's lot only contained one male from Fitch, and two specimens from Texas, one specimen from D. S. Kellicott, Ohio, and one female from myself. We notice by this the wide distribution of the species, yet but five specimens are recorded in Professor Van Duzee's paper.

It would be interesting and valuable to hear from the Entomological Society of Philadelphia, as well as from Professor Riley for the Government, in regard to this insect; also from Professor Osborn, who would know it, but, if he had had it in his collection, he would probably have sent it to Professor Van Duzee, to assist him in making up the valuable revision of this genus.

Phlepsius fuscipennis Van Duzee is a new species found by Professor Uhler and myself, and described from one pair sent him by Professor Uhler and fourteen males and two females sent by myself. Here, again, we have sufficient distribution to warrant the recording of more specimens; and we would like to hear from any source as to their habitat in other States; and this could be soon found out, were those species not known to collectors, and now in their collections, sent to Professor Van Duzee, for identification. With us they seem to be fairly abundant, and are exceedingly interesting, both on account of their rarity and markings.

Professor Van Duzee states, "that the dark colored species may be distinguished by their broad form, short inpressed vertex, and strongly wrinkled pronotum; the brown elytra of the males, spotted with white; some of the males exhibit the pale arcs on the front, and the ocelli may be black."

Phlepsius fulvidorsum Fitch has been taken by myself, but in limited numbers. It seems to have quite a wide distribution; but as yet Professor Van Duzee records as known to him but ten (10) specimens, and these from New York, Iowa, Maryland, and Texas. This must be a difficult species to determine, for, as good an Hemipterist as Professor Van Duzee is, he finds great difficulty in distinguishing between two predominant forms, which can only be well done by the study of a large series of specimens from an extended area; and if all who are interested in this order would send specimens to him and assist him, he would no doubt soon solve the problem and explain it to us so we could also know wherein the difficulty lay

Another new species, described by Professor Van Duzee and taken by myself, is *Phlepsius humidus* Van Duzee. Though not uncommon, this species is recorded but once outside of New York State, by two or three examples labeled Delta R.R. I have taken it quite frequently, and Professor Van Duzee says "it is not uncommon about Buffalo, in low, swampy meadows and other humid situations." He has also taken it near Lake Ontario, and states that this is the "large variety mentioned in his list of Hemiptera from that locality, published in the *Canadian Entomologist*, for 1889, under the name *Allygus irroratus* Say."

Jassus excultus Uhler is now to be known as *Phlepsius excultus* Uhler. This species is well recorded from New York, through Texas, to New Mexico. As yet I have not collected this species, nor does Professor J. B. Smith, in his "Catalogue of the Insects of New Jersey," record it from that State. A thorough search will no doubt reveal its whereabouts in this locality also.

Among the Jassidæ collected by me in this locality, and determined by Professor Van Duzee, is *Cicadula* 6-*notata*. It is very common and easily taken with a sweep-net.

Jassus subfaciatus Say is also common, and Professor Smith records *Jassus clittellarius* Say, and *Jassus irroratus*, now known as *Phlepsius irroratus* Say. *Athysanus* (grypotes) is represented in my collection by four species, taken here, *tergatus* Fitch, and *unicolor* Fitch, and two new species named by Professor Van Duzee as *Athysanus galbanatus* Van Duzee and *Athysanus viridius* Van Duzee. None of the species are very abundant; and they are represented in my collection by from three to six specimens, although the former two species are much more abundant that the latter. Professor Smith gives *A. fenestratus* Fitch, *minor* Fitch, *nigrinasi* Fitch, *variabilis* Fitch, *striatulus* Fallen, and *unicolor* Fitch, as *Jassus unicolor* Fitch. No doubt all these species are found here, and as far as Fitch's types are concerned, we believe, belong to this State.

In Deltocephalus I have collected *inimicus* Say, and *Sayi* Fitch, both being quite rare as far as my collecting goes. Professor Smith has *inimicus* Say recorded as *Jassus inimicus* Say. *Scaphaideus* is represented by two species, one of them new to science, and the other *Scaphaideus immistus* Say.

Athysanus is represented by *Curtisii* of Fitch, which is not uncommon with me.

In the sub-family TYPHLOCIBINÆ, we have *Typhlocyba rosæ* Fitch, and other species not yet determined, one species being very common on *Ptelea trifoliata*, *L*, and of a delicate green color. One of the undetermined species may be *trycincta* of Fitch, and recorded by Professor Smith as occurring in New Jersey.

Erythroneura vitis Harris is common with us; but I have not as yet found *comes* Say, or *vulnerata* Fitch, both found and recorded from New Jersey, and the latter from New York State also.

In the genus *Empoa*, Professor Smith records *querci* Fitch, *fabæ* Harris, and *rosæ* Harris, the latter now known as *Typhlocyba rosæ* Fitch, as before noticed.

Professor Smith also records *Cœlidea olitoria* Say, and *C. subbifasciata* Say. I have not as yet collected any of this genus, although, in the present unsettled state of the arrangement in several of the orders, it is quite impossible to state just what one has, until such an arrangement as Professor Van Duzee has given us with the genus *Phlepsius* is worked out for all the families.

It is to be hoped that hemipterists and all entomologists will assist specialists by sending them specimens; and more accurate data should be given, with the material, than, I must confess, I have been able to give in the past, so that distribution and numbers may be determined.

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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.*

On request in advance, one hundred copies of the number containing his communication will be furnished free to any correspondent.

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

Readjustments of the Loup Rivers: Examples of Abstraction Due to Unequal Declivities.

REGRETTING that my article on the "Evolution of the Loup Rivers" has been misunderstood, partly on account of an error in drawing the map, I present herewith a corrected map (Fig. 1), showing the true location of the old channel connecting the head of Wood River with the South Loup at Callaway, also some additional features not shown on the first map.

In responding to the call of Professor Davis for "examples of the lateral abstraction of one stream by another *on a slope of planation*," I must premise that planation is wholly distinct from abstraction. The efficient factor in the former process is latteral corrosion, in the latter headwater erosion. Planation shifts one stream bodily over to another, whereupon both unite in that channel, below the point of contact, which is the lower of the two. In the process of abstraction the capturing stream does not itself shift over to the captured stream, but extends one of its tributaries across the original divide by headwater erosion.

Omitting, therefore, the phrase "on a slope of planation" from the question as propounded by Professor Davis, I will say that the phenomena in the Loup valley are such as to raise a strong presumption at least that some abstractions have occurred. As he remarks, "the slopes are in the proper direction for such abstraction." Moreover, the old empty channels are there as silent witnesses of adjustments already accomplished, and the ravines of greater slope and more vigorous erosion, leading into that stream which lies at a lower level to the north-east, have already captured much more than half of the space between streams, thus threatening further abstractions in the future.

In addition to the one at the head of Wood River I would cite as another example of abandoned channels the depression leading up to the Dismal River in the line of Mud Creek, the approximate position of which is roughly indicated by dotted lines, marked "Old Channel" on the map. Mud Creek is a weak stream in a great valley, itself as eloquent a witness of change as the dry valley above. It must have carried a large volume of water, and have been a worthy mate to the Middle Loup, before it was beheaded by the Dismal, a vigorous tributary of its neighbor on the north-east — the winning side in all these re-adjustments.

To show the actual position of existing divides, as indicating further abstractions, I have traced the water-shed by dotted lines for some distance between the North and Middle Loups, and between Cedar Creek and the North Loup and Calamus River. On the latter line the distances are 13½ miles from the divide to Cedar Creek, and 4½ miles to the Calamus. The eastward stream has already captured three-fourths of the territory. On the former line, at the south-east end, the divide is 12 miles from the North Loup and 6½ miles from the Middle Loup. Here two-thirds of the divide yields allegiance to the eastward stream. At the north-west end of the same line it will be observed that the water-shed is nearer to the North Loup than the Middle Loup. This is because the North Loup is a re-adjusted stream above the mouth of the Calamus. If we measure from the latter, which is the true original head of the North Loup, the divide assumes its normal position nearer to the higher stream lying to the south-west. The larger and longer stream, called the North Loup on account of its size, is really an overgrown tributary, which owes its superior vigor to the fact that it now flows more nearly in the line of maximum gradient than does the Calamus, or the unadjusted North Loup below the confluence. The energy of westward headwater erosion is unmistakable. All of the Loups bend that way at their heads, and have their most vigorous tributaries on that side.

It is noteworthy that the North Loup, having no large, aggressive eastward neighbor, has retained its original head, the Calamus. It has itself encroached upon the territory of the Middle Loup, but that stream escaped capture by turning aggressor on its own account. Possibly its original head was captured by the North Loup. If so, it was after the Middle Loup had seized so much territory westward, including the head of the large valley in which Mud Creek now flows, that the conquest was a barren one. It was no more serious in its effects upon the Middle Loup

FIG. 1.

Drainage map of Central and Eastern Nebraska. The dotted lines along the Middle and North Loups mark the present water-shed, lying in each case nearer to the higher stream to the south-west. The short stream near x is Lost Creek, so called because it disappears in the sands of the valley. The line xy shows the trend of the buried cliffs of Cretaceous shales bounding the old gorge of the Platte.

than the capture of the Calamus by a tributary of Cedar Creek would now be to the North Loup.

Professor Todd has added some welcome and valuable contributions to this discussion (*Science*, Mar. 11, p. 148), but his objection to the "efficiency of abstraction," on account of the porosity of the strata in this region, does not appear to me to be well taken for two reasons. First, the impression given by his remarks, of the degree and extent of porosity, is exaggerated. It chimes with a widespread popular notion of extensive subterranean flows from one river to another, but the real exceptions to that general hydrographic law which predicates the volume of each river to be the product of rainfall on its own basin, are not much more frequent or striking here than elsewhere. There is no indication that the Blue receives any appreciable increment by subflow from the Platte, or the Salt from the Blue, although both are at a lower level than the larger stream to the west. Each has a volume which may all be accounted for by the size of its basin and the depth of annual precipitation. Those tributaries of the Salt which approach nearest to the Blue are the weakest; if subflow from the Blue were an important factor they should be the strongest. The divide is formed by a moraine of the first glacial epoch, running along the east bank of the Blue, where the words "Big Blue" are written on the map. This moraine is the cause of the peculiar arrangement of the tributaries of Salt Creek, and of the abrupt turn to the south of all the Blue rivers to form the Big Blue. It has the usual composition of a moraine — sand, gravel, and clay. Many examples of morainal lakes held up, and rivers turned aside, by such material, testify to the fact that it is not very porous.

Secondly, headwater erosion would not cease on account of subflow unless the latter absorbed the whole run-off. As long as there are any surface streams, and they are rather numerous in this region, they will erode their channels and, by virtue of the law of unequal declivities, push the divide towards the higher stream, ultimately abstracting the latter. If the subflow does rob them of some part of their volume and eroding power, the process will only be retarded, not prevented.

I leave it to Professor Todd to answer the question of Professor Davis respecting the deflection of rivers by rotation of the earth. He has already adduced the Platte as an example, assuming it to have flowed once in the channel of the main Loup. The accompanying profile (Fig. 2), reduced from one published by Chief Engineer E. S. Nettleton (Irrigation Survey, U. S. Dept. of Agriculture Progress Report, Part II.), will be useful in discussing this assumption. The Loup at St. Paul is 95 feet below the Platte at Grand Island. Since rivers do not shift from lower to higher levels, it is physically impossible that the Platte should have shifted from the Loup channel to its present position, unless there has been a great change of levels. But such change is claimed. Professor Todd thinks the Platte occupied the Loup channel ("the north channel already described" cannot be other than that of the main Loup, since it is said that "the Loups did formerly flow through to the Platte" in that position) "when it was flowing on a level seventy-five to a hundred feet higher, relatively, than at present." Ths would bring it up to the position of the dotted line O. C. Fig. 2, one hundred and ninety-five feet in the air above the present Loup. There are no flood-marks, or other evidences, to show that it ever flowed there. The "alluvian terrace," which is the most significant and interesting feature of Professor Todd's map, in its westward extension along the Loup, is obscured by a range of sand hills, which form a broken and ragged divide between the Loup and Prairie Creek. Its main mass, aside from the dunes blown up on its back, is *below the present channel of the Platte.* It therefore furnishes no evidence that the Platte ever flowed at a higher level between St. Paul and Grand Island. On the contrary, it furnishes distinct evidence that the same relative levels, the same relative gradients (the Loup having less fall than the Platte) and the same relative positions of the two streams existed as far back as the second glacial epoch, substantially as they now exist. Some obstruction at that time in the lower Platte, possibly an ice-dam near Fremont, raised the waters till they overflowed the divide at the head of Sand Creek. It is surprising that this new short cut did not become the permanent channel of the Platte. Possibly the ice-dam extended below Ashland, but with less elevation than at Fremont, thus permitting the new channel to be cut down to its level, but not to the level of the old channel. Hence the longer course by way of Fremont was resumed when the ice retired.

Both the Platte and the Loup are so heavily charged with sediment that a slight reduction of their gradients would cause deposition of silt, and this result of retarded flow would be felt in both streams far above the obstruction, but farther up the latter than the former on account of its lower gradient. The ice-dam ponded the Platte for some miles above it, producing still water, in which sediment rapidly accumulated. Thus was built up the eastern end of the terrace to a level "seventy to ninety feet above the

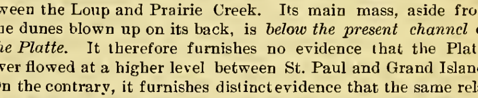

FIG 2.

Profile across the Loup, Prairie Creek, and Platte, running from St. Paul to Grand Island, Neb. Horizontal line 1900 feet above sea-level. *L.*, Loup River, 1775 ft.; *P.C.*, Prairie Creek, 1843 ft.; *P.*, Platte River, 1870 ft. above sea-level; *O.C.*, alleged old channel of the Platte.

Platte." Deposition, induced by retarded flow, an indirect result of the obstruction, extended far up the Loup on account of its low gradient. Professor Todd's map is correct in representing the terrace as following the Loup instead of the Platte above their confluence. From Columbus westward it is a Loup formation. Not only does it draw away from the Platte, but it also sinks below its level. It therefore furnishes no evidence of a change of levels, or of a shifting of waterways, but rather of the persistence of both as they now exist, since it fits well into present conditions.

Another reason for doubting this alleged shifting of waterways is found in the position and trend of the ancient rock trough of the Platte. Its buried bluffs of Cretaceous shales have been just touched by recent erosion sufficiently to reveal their existence near the mouth of Beaver Creek, along Cedar Creek, and in the bed of the main Loup between the mouths of these two creeks. The trend of these ancient bluffs is shown by the line xy on the map. It is oblique to the Loup channel, leaving the mouth of Cedar Creek, and of all three of the Loup rivers, *outside of the Platte valley*. If they ever entered the Platte directly and independently, it must have been as indicated in my article of Jan.

29, 1892. The eastward prolongation of the ancient bluffs is probably not continued in the line *yx*, but bending east about where the turn occurs in the courses of Lost Creek and Shell Creek. The former is a considerable stream so long as it has the impervious Cretaceous shales for a substratum, but soon disappears when it encounters the deep mass of silt in the Platte valley.

There is no evidence, so far as I know, that the Platte has ever shifted out of its old rock bed, except during the transient episode at Sand Creek. The existence of a gorge excavated in Mesozoic and Palæozoic rocks, once five hundred feet deep though now silted up to its brim, is the best reason for its present course. Nor can any inferences respecting the influence of rotation be drawn from the trend of this gorge, for the reason that a considerable part of it was formed by a stream which flowed *west*. When the Platte first stretched across the plains, its several parts of different ages and opposite flow being united in one great river, it found a ready-made channel, to which it has, in the main, steadily adhered. The hypothesis that it once flowed in the channel of the Loup fares badly in the light of the facts, and, looking across to the southward, we find no evidence that it ever flowed in any of the numerous heads of the Blue, as suggested by Professor Davis. None of them has any marked pre-eminence over the rest, and all of them are slight recent furrows, mostly below the level of the Platte, so that it must have shifted up-hill if it once flowed in them.

The suggestion that it once flowed in Prairie Creek falls into a different category, since this stream is within the old rock trough. But it is a mere pin scratch in a wide alluvial plain, any other line of which is just as likely as that to have been the flow-line of the Platte at some period. Of course this great river has shifted about within its rocky gorge. The most significant fact in respect to the influence of rotation is that it now, in many places, crowds upon the south bluffs, as shown in Fig. 2.

It is agreeable to have the concurrence of Professor Todd in my opinion that "the Loups did formerly flow through to the Platte.' I trust he will not recede from this harmonious attitude in consequence of finding it impossible to put the Platte over into the Loup in order to get them together. Strictly speaking, however, that is not impossible. A big canal would accomplish it literally. The real difficulty is to get the Platte back to its present higher channel. It is not now a constructive stream, building up its bed above the surrounding country, else we might suppose that it had shifted to its present position and then built it up above the Loup. It has not probably been a constructive river at any time since the Rocky Mountain uplift emptied Lake Cheyenne, and gave the Platte such a steep gradient that it is able to accomplish a little vertical erosion in spite of its great burden of sediment. It trembles on the verge between vertical erosion and deposition, the balance inclining to the former, but so slightly that it maintains its levels with great steadiness. Herein lies another reason for doubting that great changes of level have recently occurred in its valley.

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Sistrurus and Crotalophorus.

ON page XXVI. of the introduction to a work on North American Reptiles, in the "Memoirs of the Museum of Comparative Zoology," VIII., 1883, the name Sistrurus was applied to one of the two genera of rattlesnakes because Crotalophorus, the previous title, was a synonym for Crotalus, the other genus. Professor Cope, in his latest paper on the serpents, Proc. U. S. Mus., 1892, p. 624, objects to the change in these terms: "Mr. Garman has named this genus Sistrurus, on the ground that the name Crotalophorus was preoccupied at the time it was employed by Gray. This does not, however, seem to be the case. It is true that Linnæus uses it instead of Crotalus in the sixth edition of the Systema Naturæ (1748, p. 35), but the system of nomenclature thus adopted is not binomial, so that the names are not authoritative as against later ones." This makes a considerable display of lack of caution, to say the least of it. If use by Linné in the sixth edition of the Systema (as also in the seventh and the ninth editions, and the Amoenitates) was all that bore on the question there might be nothing to say. But in proposing the new name I had in mind more than appears from the citation. Linné and Gronow only were mentioned. The dates for the latter were 1756 and 1763, which brings us within the range of the tenth edition, 1758. Gronow might be put aside as unsound binomially. If so, I still had Houttuyn, 1764, who certainly regarded the names as synonymous, for he says, "De geslagtnaam deezer slangen, *Crotalophorus*, en by verkorting *Crotalus*, is afkomstig van den ratel, dien zy aan't end der staart hebben." But, again, if not allowed to go farther back than the twelfth edition, 1766, there was another authority for Crotalophorus instead of Crotalus, Vosmaer, 1768, according to whom, "De Heer Linnéus geeft de benaaming van *Crotalophorus* aan dit geslacht, in het welk hy drie onderscheidene soorten heeft opgeteekend, die hy *Horridus, Dryinas* en *Durissus* noemt."

Under the name Crotalophorus, 1748-68, neither Linné, Gronow, Houttuyn nor Vosmaer included any of the species of the genus defined by Gray, 1825, with the same name. That they were not binomial authorities may be urged against Linné and Gronow, but not against Houttuyn and Vosmaer, who, though they retained the earlier name, adopted the genus and the species from the tenth edition of the Systema. Linné dropped Crotalophorus for Crotalus in 1758. In 1766 he described the first species of the other genus, placing it in Crotalus, where it was kept by most authors until removed by Gray. The necessity of the change I have made in the name of Gray's genus is best shown by a concise view of the synonymy for the two genera.

Crotalus.

Caudisona Linn., 1735-47; Laur., 1768; Flem., 1822; Cope, 1861-71; Coues, 1875.

Crotalophorus Linn., 1748-56; Gronow, 1756-63; Houtt., 1764; Vosm., 1768.

Crotalius Linn., 1754.

Crotalus Linn., 1758-66; Daud., 1803; Merr., 1820; Gray, 1825-49; Fitz., 1826-43; Wagl., 1830; Holbr., 1842; Bd. and Gir., 1853-59; Dum. Bibr., 1854; Cope, 1859, 1875-92; Garm., 1883. (Many omitted. In most cases, from 1766 till 1825, a species of Sistrurus was included.)

Crotalinus Raf., 1815.

Uropsophus Wagl., 1830; Gray, 1831-49; Fitz., 1843.

Urocrotalon Fitz., 1843.

Aploaspis Cope, 1866-75.

Aechmophrys Coues, 1875. (The last four apply to particular species.)

Sistrurus.

Crotalophorus Gray, 1825-31, 1849; Holbr., 1842; B. and G., 1853-59; Cope, 1859, 1886-92.

Caudisona Fitz., 1826-43; Wagl., 1830; Bon., 1831; Gray, 1842; Yarr., 1875; Cope, 1875-80.

Crotalus Flem., 1822; Cope, 1860; Coues, 1875.

Sistrurus Garm., 1883.

S. GARMAN.

Mus. Comp. Zool., Cambridge, Mass.

"Scientific" Genealogy—Rejoinder, No. 2.

QUITE recently I contributed to these columns (*Science*, Vol. XIX., No. 476. "'Scientific' Genealogy—A Rejoinder."—Veritas.) a brief paper intended to curb some tendencies prevalent in genealogical circles, notably untenable assumptions regarding family traits and likenesses inherited.

Since the appearance of the above article several criticisms have been sent to this magazine — rather surprising to "Veritas" for the reason that they indicated a lack of acquaintance with what he opposed in the article.

General discussions of biology, breeding of animals — human and brute — are, I doubt not, of interest and profit, only, — they hardly touch my point in the argument, and it is important in open discussion to keep to the question, — so many readers mistake a rambling generalization for argument and fact. Then, too, I object to portions of the article by "Enquirer," namely, p. 155, paragraphs 1 and 4, as mistakenly quoting my views (for light on which my article is in evidence) and also to his last paragraph, p. 155. in which, as I read it, he eludes and dodges the question.

More and more thought in the matter only convinces me in greater degree that these words of mine "The writer does not for a moment combat the well-exhibited inheritance of peculiar appearance and traits of a man from his father or mother, his grandparents or great-grandparents, or in rare cases from great-great-grandparents, but beyond these limits the historian has little to encourage him in his attempt beyond uncertain and traditionary tales" (Rejoinder, p. 157) are safely within the truth.

Considering that "Enquirer" knows relatively nothing of $99\frac{61}{100}$ per cent of his emigrant ancestors, I still frankly disbelieve that he can locate traits or characteristics of John Doe the first, in any living descendant, with truth. However dear a hobby or theory may grow to a man, unless facts fully substantiate the theory, and it be capable of proof, it is questionable honesty and mistaken wisdom to give that theory currency as if it were fact.

As far as I can group and draw inferences from the facts, on an average the maternal blood has almost, if not full as much, influence in determining the traits and appearance of offspring as the paternal,— this with reference to human beings.

With some one hundred living descendants of a man (the man and descendants included in four generations) I have had intimate acquaintance, and neither in those bearing his surname, nor the males by themselves, nor in all together, does there appear one common trait or characteristic, which state of things I consider due to the great influence of new strains of blood brought in by marriage.

Being as yet too young, personally, to claim the experience necessary to theorize concerning likenesses, I feel that my only safety is in stating fact. I have made a specialty of gathering the likenesses of my ancestors and close relations, and from oil paintings, through silhouettes, daguerreotypes, and ambrotypes to photographs, I honestly see as much in appearance derived from the maternal blood as from the paternal. Photographs are of too recent origin, however, to affect the argument I put forward.

Could those who are interested in the matter alter their point of view long enough to realize the blending, the existing cousinship, to realize that the living child of old New England parentage has relatives (sixth cousins and nearer) to easily populate Boston, Mass., and to spare, such a light will come to them as will widen, enlarge, and much more than offset the narrow views now cherished.

"VERITAS."

BOOK-REVIEWS.

Helen Keller: Souvenir of the First Summer Meeting of the American Association to Promote the Teaching of Speech to the Deaf. Second Edition. Washington, Volta Bureau. 1892. Large. 4°.

THE great interest aroused in the education of the blind and the deaf by the remarkable story of the life of Laura Bridgman is destined to be eclipsed by the most astounding educational strides of the twelve-year-old Helen Keller. Blind and deaf since her eighteenth month, she receives her first instruction in language at seven years, she learns in days what it required months for Laura Bridgman to acquire, and within a year has a fund of knowledge and a capacity for using it quite remarkable for an eight-year-old child in full possession of the five senses. Her interest in her surroundings, her retentive memory, and appreciative imagination, her capacity to learn and reproduce are wonderful enough, but they are outdone by her remarkably quick and, from all accounts, remarkably exact acquisition of vocal speech. By placing her hands upon the mouth, lips, and throat of the speaker, she learns the position of the speech-making organs when uttering the different sounds; setting her own vocal organs in the same position she reproduces the sound, correcting it according to the instructions (by the finger alphabet) of her teacher,—an acquisition difficult enough when guided by the eye, but certainly marvelous for one both blind and deaf.

It is only natural that her story should excite interest everywhere, and the present memoir of her education tells the salient points of her life. It is admirably prepared, and contains an excellent portrait and *facsimiles* of her very remarkable letters. It is to be hoped that all the details of her career will be carefully noted and that the present is only an introduction to a fuller and more complete account of Helen Keller. It is certainly proper that the sympathy in her case should be used to excite an interest in the education of the deaf and the blind, and the souvenir will aid in this meritorious work.

Bacteriological Diagnosis: Tabular Aids for Use in Practical Work. By JAMES EISENBERG, Ph.D., M.D., Vienna. Translated and augmented with the permission of the author from the second German edition, by NORVAL H. PIERCE, M.D., Surgeon to the Outdoor Department of Michael Reese Hospital; Assistant to Surgical Clinic, College of Physicians and Surgeons, Chicago, Ill. F. A. Davis & Co., Philadelphia and London. 1892.

THIS is, without exception, the worst translation that has ever fallen into our hands. Not only this, but it exhibits throughout an utter ignorance of bacteriology on the part of the translator. We cannot but express the greatest astonishment at the temerity shown by the translator in attempting the task, deficient as he evidently is not only in the knowledge of the German language but also in the subject treated. To set forth all the errors would be to write another book, so we will make but a few quotations to show that our condemnation is not too severe.

Beginning with the first page, we find in the preface "a bacteria" occurring twice instead of "a bacterium," and "bacteriæ" instead of "bacteria." In the index, Bacillus "sublilis" instead of "subtilis" is seen, which might be an oversight if it were not again misspelt at the head of the tabulated description (No. 14) which deals with this organism. We will pass over a vast number of comparatively small mistakes such as the translations "pretty" for "schön," "nourishing-ground" for "Nährboden," "faint" for "matt" (dull), "spirules" and "spirillæ" for "spirilla," "flagellæ" for "flagella," "color-glass" for "Blende" (diaphragm), "object-glass" for slide, "éprouvette" for test-tube, "whitish fimbria" for "weislichen Saum" ("whitish border" would be more the author's meaning), and "slim staves" or "staffs" for "schlanke Stäbchen" (we usually speak of "rods" when speaking of bacilli). Wherever microscopic measurements are given we find "m." (meters) instead of "μ." On pages 14. 15 and 57, minus signs are omitted from in front of temperatures ranging from —10° to —20° C., thus taking all meaning out of the translation.

Serious errors would be represented by such translations as these, taken at random: P. 17, where the growing out of the Bacillus subtilis from spores is described "Stäbchen sprossen senkrecht auf die Längsachse der Sporen aus," translated "Staves sprout in the direction of long axis of spores." P. 24, "Häufchen, die zu einer kernigen, brauner Masse mit abgerundeten Ecken zusammenfliessen," translated "heaps, which amalgamate into a seedy, brown mass." Same page, "Umfangreiche, schnelle Verflüssigung, vom ganzen Impfstich gleichmässig ausgehend; gelbliche Verfärbung," translated "Growth elaborate, yellow, and quickly liquefying. The growth spreads from the entire inoculation point." P. 53, "im Condensationswasser," translated "in the water expressed in desiccation." P. 57, "Im Darminhalt von frischen Choleraleichen und Stuhlentlerungen Cholerakranker," translated "In the intestinal canals of recently moribund cholera patients and from the fæces of the same." Same page, "Am Anfang des Stichkanals bildet sich ein kleiner Trichter, es tritt Verflüssigung längs des Impfstichs ein, an der Oberfläche entsteht luftblasenartige tiefe Eisenkung," translated "Liquefaction begins slowly, commencing at the entrance of the puncture around an inclosed air bubble." Same page again, "nach Unterbindung der Gallengänge," translated "after ligature of the intestine below the bile duct." On p. 63 one's astonishment is somewhat increased by finding "verschiedenartige Zeichnung" translated "indifferent pictures." "Wasserstoff" (hydrogen) translated "water" — "ohne Sauerstoffzuführ" as "without addition of acid." On p. 72, "Schnittpräparaten" (sections) translated "excised preparations." On p. 79, instead of "Rauschbrandbacillus" we find "anthrax bacillus." It is pleasing to read (p. 86) that the spore formation of Bacillus anthracis "occurs most plenteous at breeding temperature." We cannot agree that the equivalent of the German "welche in der Richtung der Längsachse der Mutterzelle auskeimen," is given in "which spring from the long axes of the maternal cells." On p. 96, where the effects of the injection of Staphylococcus pyogenes aureus into the blood-vessels are considered, "nach Lädierung der Herzklappen" is translated "later they attack the valves of the heart," and so we might go on indefinitely.

In the third German edition of this book, which appeared in 1891, 376 micro-organisms are described, whilst this translation of the second edition appears in 1892 and describes some 133 micro-organisms. The appendix belonging to the third German edition, which was not present in the second edition, has been added to the translation of the latter. We have not noticed much that is "augmented" in the translation, but much that is distorted and misstated. The climax was reached when we found the Plasmodium malariæ (not mentioned in Eisenberg at all) classified under the heading "Pathogenic Bacteria." In justice to the publishers, we are only too happy to remark that the printing, and especially the binding of this book are well done.

On one point the translator justly gives himself credit, and that is in the preface where he says, "The arrangement of the text has been somewhat changed from the original." G. H. F. N.

AMONG THE PUBLISHERS.

A GUIDE-BOOK is a *sine qua non* to the average American bound for a summer's trip in Europe. But, aside from the stock information which the regulation books of that class contain, there is a large number of questions in regard to foreign things and ways which remain open, and it is to help the tourist to just such additional and most necessary information that Brentano's, New York, has just brought out "Abroad and at Home," by Morris Phillips, the well-known editor of *The Home Journal*. In this book can be found accounts of the author's experiences while in Great Britain and France, and the close of the volume contains much similar information about our Southern States and the Pacific Coast, this last justifying the "At Home" in the title.

— Thomas Curtis Clarke, the eminent engineer, in the June number of *Scribner's* will suggest a solution for the problem of rapid transit as it now confronts the cities of New York, Chicago, and Boston. The New York plan, which he favors, involves a new street with an open-air viaduct on one side of it, abutting on great warehouses, the lower stories of which enter directly into the tunnel for freight trains beneath the viaduct.

— Messrs. Macmillan & Co. are about to issue, under the title of "Calmire" (a name of French origin, pronounced Calmēre), an exposition, through the medium of a story, of that scientific explanation of the basis of morals, for which many are seeking out-

CALENDAR OF SOCIETIES.

Society of Natural History, Boston.

May 18.—J. S. Kingsley, Notes on the Anatomy of Amphiuma; W. O. Crosby, On Some Evidences of Tertiary Deposits in the Boston Basin.

Biological Society, Washington.

May 14.—W. H. Seaman, The Photogenic Organs of Fireflies; C. Hart Merriam, A New Prairie Dog from Mexico; Charles Hallock, Where Salt-Water Fishes Hide: Results of Deep-Water Seining; Theo. Holm, Additions to the Flora of Washington (with exhibition of specimens); Frederick V. Coville, The Use of Certain Terms in Geographic Distribution.

Publications Received at Editor's Office.

BERNARD, HENRY MEYNERS. The Apodidae. New York, Macmillan & Co. 12°. 336 p. $2.

BUTLER, AMOS W. The Birds of Indiana. Brookville, Ind., Wm. B. Burford, printer. 8°, paper. 135 p.

NAEGELI, CARL AND SCHWENDENER, S. The Microscope in Theory and Practice. Trans. from the German. 2d ed. New York, Macmillan & Co. 8°. 394 p., ill. $2.60.

SMITHSONIAN INSTITUTION. Report of the National Museum for the year ending June 30, 1891. Washington, Government. 8°. 954 p.

U. S. BOARD ON GEOGRAPHIC NAMES. First Report. 1890–1891. Washington, Government. 8°. 56 p.

WEED, ALONZO R. Business Law. Revised ed. Boston, D. C. Heath & Co. 8°. 172 p. $1.10.

Business Department.

Exchanges.

[Free of charge to all, if of satisfactory character. Address N. D. C. Hodges, 874 Broadway, New York.]

Taxidermist going out of business has quantity of finely-mounted specimens of North American birds, mammals and reptiles and skins of birds for sale, including a full local collection of bird skins, showing some great variations of species; also quantity of skulls with horns of deer and mountain sheep, and mounted heads of same. Will give good exchange for Hawk Eye camera with outfit. Apply quickly to J. R. Thurston, 265 Yonge St., Toronto, Canada.

For exchange.—A fine thirteen-keyed flute in leather covered case, for a photograph camera suitable for making lantern slides. Flute cost $27, and is nearly new. U. O. COX, Mankato, Minn.

To exchange; Experiment Station bulletins and reports for bulletins and reports not in my file. I will send list of what I have for exchange. P. H. ROLFS, Lake City, Florida.

Finished specimens of all colors of Vermont marble for fine fossils or crystals. Will be given only for valuable specimens because of the cost of polishing. GEO. W. PERRY, State Geologist, Rutland, Vt.

For exchange.—Three copies of "American State Papers Bearing on Sunday Legislation," 1891, $2.50, new and unused, for "The Sabbath," by Harmon Kingsbury, 1840; "The Sabbath," by A. A. Phelps, 1842; "History of the Institution of the Sabbath Day, Its Uses and Abuses," by W. L. Fisher, 1859; "Humorous Phases of the Law," by Irving Browne; or other works amounting to value of books exchanged, on the question of governmental legislation in reference to religion, personal liberty, etc. If preferred, I will sell "American State Papers," and buy other books on the subject. WILLIAM ADDISON BLAKELY, Chicago, Ill.

For Sale or Exchange for books a complete private chemical laboratory outfit. Includes large Becker balance (200g. to 1-10mg.), platinum dishes and crucibles, agate motors, glass-blowing apparatus, etc. For sale in part or whole. Also complete file of *Silliman's Journal*, 1862–1885 (62–71 bound); Smithsonian Reports, 1854–1883; U. S. Coast Survey, 1854–1869. Full particulars to enquirers. F. GARDINER, JR., Pomfret, Conn.

Wanted, in exchange for the following works, any standard works on Surgery and on Diseases of Children: Wilson's "American Ornithology," 3 vols.; Coues' "Birds of the Northwest" and "Birds of the Colorado Valley," 2 vols.; Minot's "Land and Game Birds of New England;" Samuels' "Our Northern and Eastern Birds;" all the Reports on the Birds of the Pacific R. R. Survey, bound in 2 vols., morocco; and a complete set of the Reports of the Arkansas Geological Survey. Please give editions and dates in corresponding. R. ELLSWORTH CALL, High School, Des Moines, Iowa.

To exchange Wright's "Ice Age in North America" and Le Conte's "Elements of Geology" (Copyright 1882) for "Darwinism," by A. R. Wallace, "Origin of Species," by Darwin, "Descent of Man," by Darwin, "Man's Place in Nature," Huxley, "Mental Evolution in Animals," by Romanes, "Pre-Adamites," by Winchell. No books wanted except latest editions, and books in good condition. C. S. Brown, Jr., Vanderbilt University, Nashville, Tenn.

Wants.

Any person seeking a position for which he is qualified by his scientific attainments, or any person seeking some one to fill a position of this character, be it that of a teacher of science, chemist, draughtsman, or what not, may have the 'Want' inserted under this head FREE OF COST, *if he satisfies the publisher of the suitable character of his application. Any person seeking information on any scientific question, the address of any scientific man, or who can in any way use this column for a purpose consonant with the nature of the paper, is cordially invited to do so.*

WANTED.—A teacher of Geology who is familiar with the fossils of the Hamilton Group, as instructor of Geology during July next at the Natural Science Camp on Canandaigua lake. Apply to ALBERT L. AREY, Director, 229 Averill Ave., Rochester, N. Y.

WANTED.—To act as correspondent for one or two daily or weekly papers. Have worked on paper for about two years. Would like a position on editorial staff of humorous paper. Address GEO. C. MASON, 14 Elm St., Hartford, Conn.

TRANSLATOR wanted to read German architectural works at sight (no writing). One familiar with technical terms desired. Address "A.," Box 149, New York Post Office.

WANTED.—A position in a manufacturing establishment by a manufacturing Chemist of inventive ability. Address M. W. B., care of *Science*, 874 Broadway, N. Y.

WANTED.—Books on Anatomy and Hypnotism. Will pay cash or give similar books in exchange. Also want medical battery and photo outfit. DR. ANDERSON, 182 State street, Chicago, Ill.

WANTED.—A college graduate with some normal training, to teach the sciences, at $1,800 per year, in a Southern college. A Baptist or a Methodist preferred. Must also be a first-class Latin scholar. A. H. Beals, Box K, Milledgeville, Ga.

A PROFESSORSHIP in Chemistry is wanted by one who has had five years' experience in that capacity. Would prefer to give instruction by lectures and experiments rather than by text-book methods. Would like a position in a college or university where there is a good student's laboratory. Special points of strength claimed are: (1) Thorough control of a class and good order during lectures and recitations. (2) Accuracy in experimenting with chemicals and skill in the manipulation of chemical apparatus. The permission of several distinguished educators has been given to refer to them if required. Would not care to accept a position paying less than $1,500. Address B. E., care of *Science*, 874 Broadway, New York.

ADDRESS WANTED.—Will some one please send the address of the Secretary of the American Philological Society. Also that of Herbert Spencer. "ADDISON," Room 84, 164 Madison St., Chicago, Ill.

ADDRESSES of Old Book Dealers wanted.—Wishing to obtain a number of old books out of print, I very much desire the addresses or catalogues of rare second-hand book dealers. If there is a directory or list of such dealers I should like to obtain possession of one. W. A. BLAKELY, Chicago, Ill.

side of the historic creeds. It is entirely distinct in theory and mode of treatment from the widely-read novels touching on the religious question, and will take a place among the books most thoughtfully discussed by that increasing class of readers, which finds in the insistent problems of religion and the proletariat the most absorbing interests of the day.

— P. Blakiston, Son, & Co., Philadelphia, announce "Materia Medica, Pharmacy, Pharmacology, and Therapeutics," by Wm. Hale White, M.D., Physician to, and Lecturer on Materia Medica at Guy's Hospital; Examiner in Materia Medica Royal College of Physicians and Royal College of Surgeons, etc. This is an American copyright edition, edited by Reynold W. Wilcox, M.A., M.D., Professor of Clinical Medicine at the New York Post-Graduate Medical School and Hospital, Assistant Visiting Physician Bellevue Hospital, etc.

— The ninth volume of the new edition of "Chambers's Encyclopædia" is in a forward state, and will be published by the J. B. Lippincott Company in June. Another volume will complete this excellent work of reference The following are some of the principal articles and authors in the new volume: "Rousseau," Rev. H. G. Graham; "Runes," Canon Isaac Taylor; "Russia," "St. Petersburg," "Siberia," Prince Krapotkine; "Salmon," Archibald Young; "Salvation Army," Bramwell Booth; "Samoa," C. P. Lucas; "George Sand," Mr. G. Saintsbury; "Scandinavian Mythology." Professor Rasmus Andersen; "Schopenhauer," Professor W. Caldwell; "Schleiermacher," Dr. Otto Pfleiderer; "Spectrum," Professor Knott; "Scotland," history, Professor Grub; "Scottish Language," Dr. J. A. H. Murray; "Scottish Literature," Hume Brown; "Sir Walter Scott," Andrew Lang; "Seal," "Sole," J. T. Cunningham; "Secularism," Mr. G. J. Holyoake; "Shakespeare" and "Shelley," Professor Dowden; "Sheep." James MacDonald; Generals "Sheridan" and "Sherman," General Grant Wilson; "Shipbuilding," David Pollock; "Shorthand," Isaac Pitman; "Siam," J. S. Black; "Slang," C. G Leland; "Socialism," T. Kirkup; "Herbert Spencer," Professor Sorby; "Sphinx," Stanley Lane-Poole; "H. M. Stanley," J. S. Keltie; "Dean Stanley," Professor Story; "State Religion," Canon Curteis; "Steam" and "Steam-Engine," Professor A. B. W. Kennedy; "Sterne," Traill; "Strawberry," Blackmore.

QUERY.

Can any reader of *Science* cite a case of lightning stroke in which the dissipation of a small conductor (one-sixteenth of an inch in diameter, say,) has failed to protect between two horizontal planes passing through its upper and lower ends respectively? Plenty of cases have been found which show that when the conductor is dissipated the building is not injured to the extent explained (for many of these see volumes of Philosophical Transactions at the time when lightning was attracting the attention of the Royal Society), but not an exception is yet known, although this query has been published far and wide among electricians.

First inserted June 19. No response to date.

N. D. C. HODGES,
874 BROADWAY, NEW YORK.

TO THE READERS OF SCIENCE.

PUBLISHER'S ANNOUNCEMENT.

OUR PLANS.

WITHIN the past six months the use of *Science* by scientific men and women as a medium for prompt publication and weekly discussion, has increased very materially, so that the pages are now well filled each week with original matter. As the number of those promising contributions is increasing at the rate of three or four each day, it cannot be long before *Science* at its present size will be too small for the amount of matter offered. We have under consideration therefore an enlargement of the paper by one-half, but must first learn the temper of our constituency as to an advance in price to $5.00, which was the subscription price from the start for four years, up to June 30, 1887. Further, to carry out the proposed enlargement, we shall need five hundred additional subscribers. If you are not already a subscriber, are you willing to aid in making *Science* more worthy of American scientific work by becoming one?

It goes without saying, that the demand for scientific literature is limited, when compared with that for literature which is more to the public taste, so that the receipts of most of the Scientific Journals, in this country, do not pay quite for their printing and paper, to say nothing of the other items of expense. We say this merely to emphasize the fact, that generous and prompt support must be accorded this move if it is to succeed.

Titles of Some Articles Published in *Science* since Jan. 1, 1892.

Aboriginal North American Tea.
Actinism.
Amenhotep, King, the tomb of.
Anthropology, Current Notes on.
Arsenical Poisoning from Domestic Fabrics.
Anatomy, The Teaching of, to Advanced Medical Students.
Astronomical Notes.
Botanical Laboratory, A.
Brain, A Few Characteristics of the Avian.
Celts, The Question of the.
Collection of Objects Used in Worship.
Deaf, Higher Education of the.
Diphtheria, Tox-Albumin.
Etymology of two Iroquoian Compound Stems.
Eye-Habits.
Family Traits, Persistency of.
Fishes, The Distribution of.
Fossils, Notice of New Gigantic.
Grasses, Homoptera Injurious to.
"Healing, Divine."
Hemipterous Mouth, Structure of the.
Hypnotism among the Lower Animals.
Hypnotism, Traumatic.
Indian occupation of New York.
Influenza, Latest Details Concerning the Germs of.
Infant's Movements.
Inventors and Manufacturers, the American Association of.
Iowa Academy of Sciences.
Jargon, The Chinook.
Klamath Nation, Linguistics.
Lightning, The New Method of Protecting Buildings from.
Lissajou's Curves, Simple Apparatus for the Production of.
Maize Plant, Observations on the Growth and Chemical Composition of.
Mineral Discoveries, Some Recent, in the State of Washington.
Museums, The Support of.
Patent Office Building, The.
Pocket Gopher, Attempted Extermination of.
Psychological Laboratory in the University of Toronto.
Psychological Training, The Need of.
Rain-Making.
Rivers, Evolution of the Loup, in Nebraska.
Scientific Alliance, The.
Star, The New, in Auriga.
Storage of Storm-Waters on the Great Plains.
Teaching of Science.
Tiger, A New Sabre-Toothed, from Kansas.
Timber Trees of West Virginia.
Tracheæ of Insects, Structure of.
Vein-Formation, Valuable Experiments in.
Will, a Recent Analysis of.
Wind-Storms and Trees.
Wines, The Sophisticated French.
Zoology in the Public Schools of Washington, D. C.

Some of the Contributors to *Science* Since Jan. 1, 1892.

Aaron, Eugene M., Philadelphia, Pa.
Allen, Harrison, Philadelphia, Pa.
Baldwin, J. Mark, University of Toronto, Canada.
Barnes, Charles Reid, Madison, Wis.
Baur, G., Clark University, Worcester, Mass.
Beal, W. J., Agricultural College, Mich.
Beals, A. H., Milledgeville, Ga.
Beauchamp, W. M., Baldwinsville, N.Y.
Boas, Franz, Clark University, Worcester, Mass.
Bostwich, Arthur E., Montclair, N J.
Bradley, Milton, Springfield, Mass.
Brinton, D. G., Philadelphia, Pa.
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Comstock, Theo. B., Tucson, Arizona.
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Flexner, Simon, Johns Hopkins University, Baltimore, Md.
Foshay, P. Max, Rochester, N.Y.
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Hale, George S., Boston, Mass.
Hale, Horatio, Clinton, Ontario, Canada.
Hall, T. Proctor, Clark University, Worcester, Mass.
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Haworth, Erasmus, Oskaloosa, Iowa.
Hay, O. P., Irvington, Ind.
Haynes, Henry W., Boston Mass.
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Hewitt, J. N. B., Bureau of Ethnology, Washington, D.C.
Hicks, L. E., Lincoln, Neb.
Hill, E. J., Chicago, Ill.
Hill, Geo. A., Naval Observatory, Washington, D.C.
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Howe, Jas. Lewis, Louisville, Ky.
Hubbard, Gardiner G., Washington, D.C.
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MacDonald, Arthur, Washington, D.C.
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Osborn, Herbert, Agricultural College, Ames, Iowa.
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Todd, J. E., Tabor, Iowa.
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PUBLICATIONS.

THE LABRADOR COAST.

A JOURNAL OF TWO SUMMER CRUISES TO THAT REGION.

WITH NOTES ON ITS EARLY DISCOVERY, ON THE ESKIMO, ON ITS PHYSICAL GEOGRAPHY, GEOLOGY AND NATURAL HISTORY, TOGETHER WITH A BIBLIOGRAPHY OF WORKS, ARTICLES, AND CHARTS RELATING TO THE CIVIL AND NATURAL HISTORY OF THE LABRADOR PENINSULA.

By ALPHEUS SPRING PACKARD, M.D., Ph.D.

Sportsmen and ornithologists will be interested in the list of Labrador birds by Mr. L. W. Turner, which has been kindly revised and brought down to date by Dr. J. A. Allen. Dr. S. H. Scudder has contributed the list of butterflies, and Prof. John Macoun, of Ottawa, Canada, has prepared the list of Labrador plants.

Much pains has been taken to render the bibliography complete, and the author is indebted to Dr. Franz Boas and others for several titles and important suggestions; and it is hoped that this feature of the book will recommend it to collectors of *Americana*.

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SCIENCE

NEW YORK, MAY 27, 1892.

A KEY TO THE MYSTERY OF THE MAYA CODICES.

I WISH to announce through *Science* to those interested in the subject, that I have fortunately discovered, at last, the key which will unlock the mystery of the Maya Codices and, probably, of the Central American inscriptions. The progress of decipherment will be slow, but, the clue having been obtained, it will ultimately be accomplished. I have already determined the signification of some dozens of characters and in several instances ascertained the general sense of a group forming a sentence.

This discovery settles at the same time several other points. First, it shows that the direction in which the Codices are to be read is as assumed by me in the "Study of the Manuscript Troano," pp. 136–141. Second, that the parts of the compound characters are to be read chiefly in the same way;

that is, from left to right and from the top downward. It shows, in the third place, that, although there are a number of conventional symbols, yet the great majority of the characters are truly phonetic, and the writing of a higher grade than has been hitherto supposed. Last, it shows that, after all, Landa's statements in regard to the mode of writing and the letters and characters are, to a large extent, correct. For example, his second *b* is correct if a central dot is inserted, giving five instead of four. His c is also correct, as are his *e*, *i*, and *ca*, his *k*, *ku*, *z*, *ha*, *ma*, and sign of aspiration. The *l* as given in his example of the mode of writing is correct. His first *x* (dz), if placed horizontally and slightly modified, is the symbol for *ch'*.

Landa's trouble as to the Maya mode of spelling, where he assumes that *le* is written thus, *ele*, arises from the fact that the beginning of the symbol for *l* is so nearly like that for *e*, that he has mistaken one for the other, thus considering the first part of the *l* as an *e*. This can be shown, as symbols for the same word, having the same meaning, are found at one point in the Codex Troano.

As one result of this discovery, I will introduce here an example, with illustration from page 32 of the Cortesian Codex. In the figure here shown the reader will observe a character in the hand of the human being represented as grasped in the mouth of the serpent and also one from which the serpent seems to rise. The latter is the symbol for *cab*, which in the Maya language signifies both earth and honey, here undoubtedly earth. The one in the hand of the human figure is a compound symbol for *yeb* or *yeeb*, signifying mist, dew, or humidity. We also observe in the eye of the human head a cross, which, like the serpent, is a rain or moisture symbol; thus agreeing with the view which has been advanced in regard to the signification of these symbols.

Without further reference at present to the discovery, I may say that I am preparing specimens of my interpretations and explanations, to be submitted to some of our leading archæologists and linguists.

In concluding, allow me to say that if I am correct in the above deductions, which have been reached after careful examination and tests, the Bureau of Ethnology, of which I have the honor to be a member, may claim to have rendered probable the solution of two important questions relating to the pre-Columbian times of our continent, to wit: Who were the mound builders? and, What is the significance of these curious Central American inscriptions and Maya writings?

CYRUS THOMAS.

Washington, May 17.

DR. D. H. STORER'S WORK ON THE FISHES.

SUCH of Dr. Storer's papers as have come to my notice, some of the minor articles possibly being overlooked, indicate that his activity as an ichthyologist extended over a period of about thirty years, beginning about 1836. His list of publications on the fishes is not a long one, and his standing amongst the workers of his own period, or of later periods, in this department of science, may be determined entirely from the latest, his greatest work, "The History of the Fishes of Massachusetts."

1. The earliest paper noted is entitled "An Examination of the 'Catalogue of the Marine and Fresh-Water Fishes of Massachusetts,' by J. V. C. Smith, M.D.," in Professor Hitchcock's "Report on the Geology, Mineralogy, etc., of Massachusetts." This appeared in Vol. I. of the *Boston Journal of Natural History*, pp. 347–365, pl. viii., occupying some eighteen pages, and bearing date of May, 1836.

2. In July, 1839, he published his "Remarks on the 'Natural History of the Fishes of Massachusetts,' by J. V. C. Smith, M.D.," in Vol. XXXVI. of *Silliman's American Journal of Science and Arts*, pp. 337-349, previously read before the Boston Society of Natural History at its meeting on March 20 of the same year.

3. His Reports on the Ichthyology and Herpetology of Massachusetts make an octavo of 253 pages and three plates. This was issued in connection with the report on the Birds, by Mr. Peabody. The Report on the Fishes was also pub-

lished in the *Boston Journal of Natural History*, Vol. II., pp. 289–558, where it differs very little from the separate. This report well represents the best American work done in ichthyology up to 1840.

4. In 1841 he published a short "Supplement to the Ichthyological Report," in the *Boston Journal of Natural History*, Vol. III., and in 1844, in the fourth volume of the same journal, his "Additional Descriptions of, and Observations on, the Fishes of Massachusetts."

5. The year 1846 saw the appearance of "A Synopsis of the Fishes of North America," an extensive work, mainly compilation, published in the Memoirs of the American Academy of Arts and Sciences, and reprinted separately, with different title-page, paging, and index, making a quarto volume of about 300 pages. In this work there are evidences that compiling was not so much to the author's liking as original work, in which he certainly attained a greater degree of success.

6. The "Catalogue of the Fishes of South Carolina" in Tuomey's Report on the Geology of South Carolina, of 1848, is a list of nominal species occupying several pages, for which dependence was placed on literature rather than on specimens.

7. In the fifth volume of the Memoirs of the American Academy of Arts and Sciences, 1853–55, Dr. Storer put forth the first, second, and third instalments of "A History of the Fishes of Massachusetts." The fourth part appeared in Vol. VI., 1858, the fifth in Vol. VIII., 1863, and the last in Vol. IX., 1867. The whole was published separately as a handsome quarto of 287 pages and 39 plates. This work contains descriptions and drawings taken from specimens of more than 130 species, together with a great mass of detail concerning habits, capture, economic value, and the like.

To show how the author regarded his own work we may quote the following, the opening paragraphs of the History:

"As one of the Commissioners on the Zoology of Massachusetts, in the year 1839, I prepared a Report on the Ichthyology of the State. From the brief time occupied in its preparation, it was necessarily imperfect, and, not being accompanied by figures, was comparatively useless, except to scientific men. Since the appearance of that communication, much information has been obtained respecting several of the most common and valuable fishes, and quite a number of new species have been ascertained to exist in our waters.

"Having carefully re-described all the species, I trust the following paper will present an accurate history of the fishes of our State. Considering this as the completion of my former report, I have kept in view the primary object of the commission,— to ascertain the value of our fauna in an economical point of view, rather than to prepare labored scientific descriptions."

The estimate placed by the author on his work in the report of 1839 may leave an imperfect idea of its real value. As he was engaged in revising and enlarging it, it was but natural for him to consider it not what it should be; yet for many years it was the standard work on our fishes, and was only supplanted in New England esteem by the revised, extended, and fully illustrated work completed in 1867.

It is through this last our author should be judged, all of the others being preparatory. Comparing the records included in its pages with the other records of the period, we shall have to rank it with the best. At the present, details are valued more highly, but to a considerable extent the details are supplied in the excellent drawings from nature, by the pencil of the artist, Sonrel, so long and so happily employed by Professor Agassiz. If we place this work on our own fishes by the side of those devoted to the fishes of other States; Mitchell's New York, 1818; Rafinesque's Ohio, 1819–20; Dekay's New York, 1842; Thompson's Vermont, 1842; Kirtland's Ohio, 1839–44; Baird 'sNew Jersey, 1855; Holbrook's South Carolina, 1860; or Holmes's Maine, 1862, we find but one or two that approach it and none that surpass. The excellence of the descriptions and illustrations is generally admitted. Taking up economic considerations, the work is readily seen to be in advance of any of the others. Being a forerunner of the fishery commissions, of either the general government or of the different States, Dr. Storer had to gather his statistical or other information directly from the markets or from the fishermen. One who has not engaged in similar work can hardly realize the magnitude of such an undertaking. In the evidence that accumulates there is apt to be so much that is more positive than accurate that at times it seems an almost hopeless endeavor to discover the truth. The Doctor, however, has acquitted himself admirably. He seems to have been especially fortunate in selecting the men on whom he depended most for assistance. Such names as those of Captain N. E. Atwood of Provincetown or Captain Nathaniel Blanchard of Lynn are often cited as authorities for statements of fact, and I have never yet been able to learn of a single instance in which their testimony has proved other than absolutely trustworthy.

The "History of the Fishes of Massachusetts" is a Classic in North American ichthyology that must serve as the basis for the future histories of New England's fishes. In the quarter of a century that has passed since its publication we have changed our ideals of names; and discoveries of new genera or species, or in the anatomy, have compelled changes in the arrangement. The nomenclature of the book has become somewhat antiquated, and the systematic arrangement is not entirely suited to the present time, yet we must say the same of all the contemporaneous ichthyological literature, and it will not be long before a similar characterization will be equally applicable to the works of to day. But it matters comparatively little to this book how much the names are changed, how radically the classification is modified, the things are described here, the illustrations are here, the facts are here, and these give the work a permanent value. It would be difficult to point out a work of greater accuracy in detail, or one that left less doubt in regard to the identity of the different forms to which attention is directed.

Dr. Storer was not led astray by desire for novelty; he used little of his energy in searching for generalizations; he appears rather to have given himself up to the careful preparation of a good record of what he could gather during years of collection and study. Most will admit that in this his judgment was good. For, though it sometimes happens that science is benefitted and fame is brought to an author by a revolutionary change in classification, or through a brilliant generalization or theory, the result most often is only an evanescent notoriety that soon dies away. It is through the patient elaboration of facts and success in recording them that one is most certain of contributing to the advancement of science. In this way Dr. Storer has made a contribution to ichthyology of lasting importance. In the amount of information given, its accuracy, and style of presentation, he has established his claim to present and future gratitude and has proved his right to rank amongst the foremost of American ichthyologists.

S. Garman.

Mus. Comp. Zool., Cambridge, Mass.

THE RELATION OF BUSINESS TO COLLEGE EDUCATION.

THE question of the benefit and advantage of a college education in relation to business was some time ago freely discussed in some of our leading magazines. Many of the articles were not without a grain of truth, yet in some of them the authors seemed to disregard certain essential questions.

It is not the purpose so much of higher education to fill the mind with knowledge as it is to discipline and develop the mind, and it is not so much the object of the college to make professional men as it is to prepare the student for a professional career.

An inquiry into the psychical constitution of normal beings will show some marked general characteristics. For example, some possess great executive powers associated with marked powers of application and execution; others possess great reflective powers associated with slight powers of execution and little or no executive ability; and others again may possess all these powers equally strong, or they may be variously combined in individuals as to degree and quality. The intention is not to enumerate any more characteristics than such general ones as come into use in business. All these powers admit only of a certain degree of development.

It is conceded that every normal being is endowed with certain natural abilities to acquire knowledge. The degree of the development of these abilities and the direction in which they run are often difficult to determine; and here it is where the largest number and most serious mistakes are made. Every individual, no matter what his abilities are, must receive a certain amount of training and education, and these may come to him in one form or another, either practical, theoretical, or both. The acquisition of knowledge through personal experience alone will prove both good and bad, and it is through a theoretical training and education that the bad may be avoided. In discriminating between all the degrees of natural abilities supplemented with practical training and natural abilities supplemented with book learning, an important element will be found which can only be acquired through systematic book training and proper schooling, and that is discipline. Discipline gives discriminating powers and quickness to the perception, lends accuracy to the conception, aids the reason to draw proper conclusions from a series of facts, and thereby sharpens the judgment, develops the memory, controls the will, and subjects the emotions. In connection with this, the attention may be called to the fact that a methodical mind is not always a well disciplined mind.

Again, there is a distinguishing element common only to natural ability, and which does not depend upon knowledge alone or any higher psychical organization called knack. This is generally noticeable in powers of execution. For example, if we observe a number of mechanics working at the same job, it will appear that a few of them show exceptional facility in the execution of their work, while others with all their training and practice cannot attain this facility. The degree of difference in the work may not be great, yet it is noticeable; and the man who is the happy possessor of this particular gift is the man most sought for.

A comparison of various individuals within the different classes in which men may be classified from the standpoint of vocation will show similar results. As an illustration we need only to take two orators. Suppose them as nearly as possible to be equally equipped mentally, morally, and physically, yet when addressing an assembly there will be seen a marked difference in the effect produced upon the audience. To the one they will listen with indifference; to the other they will appear as if they drank in every word that fell from his lips. So again, if two orators unequal in education and training address an audience, it is not infrequent that the one possessed of the lesser education and training will hold his audience spell-bound, while the other will leave his audience cold and unaffected. The question will now arise, To what can this difference be attributed? The solution undoubtedly lies in the peculiar, fascinating influence exercised over the listeners through the method, the style. It is this which inspires truthfulness, conviction, and confidence, and may be considered a quality of executive ability. In every vocation of life we may trace this quality as essential to success. The author, the poet, the lawyer, the actor, the politician, the merchant — all of whatever class will profit by possessing this quality. True, this quality may be developed to a limited extent, yet the possessor of it by nature need have hardly any schooling or training, and he will succeed.

The questions, which will now present themselves for consideration, are, Why is it that so many men of very inferior mental capacity and in some instances of marked natural ability, though uneducated, are so successful in accumulating large fortunes, and why is it that so few college-bred men are successful in the commercial world and become possessors of large fortunes?

It is not infrequent where men equally equipped mentally, either educated or uneducated, start out in the world both having the same habits of thrift and economy, of industry and energy, of perseverance and endurance, and both having equally good opportunities for making money, that one of them succeeds in accumulating a large fortune, while the other gets along but moderately. The statement is quite generally admitted that a person who is economical, prompt, reliable, honest, and accommodates himself to the circumstances, and does not meet with any misfortune, may acquire sufficient means to live fairly well, but to acquire a large fortune something more is requisite.

To what this difference may be ascribed is the question. Surely, it cannot be maintained that one has more brains than the other or that he possesses better advantage by whatever means, for the assumption is that they are equal in these respects. Then the only factor to which this can be attributed is unquestionably the style or peculiar influence they exercise over others, and by which they inspire confidence and enlarge their circle of patrons. As an argument in favor of this view a reference to cases where men are totally unworthy of confidence needs only to be made. How often does it happen that men morally perverted are capable of inspiring confidence in people, and this not only in the unwary and ignorant but in men of brains and education. How often do men of inferior intellect exercise much influence among the educated and ignorant. To attribute this to any other power than the peculiar fascinating influence that many men have over others is absurd. The average business man, however great his success may be, and who has received no college training, is narrow, emotional, exacting, and will often resort to means in accomplishing his purposes which a college educated man would hesitate to do, and most college-bred men of this stamp will possess these traits inherently.

That the school of experience quickens self-reliance, that it gives positiveness to one's opinious and conduct, that one more readily forms his final conclusions from first impressions, and that a well disciplined mind might avert many sad experiences, which an undisciplined mind is obliged to go through, is undisputed. That the college graduate has many edges to round off when he enters upon the struggle for existence is manifest. During his entire college course he has ouly heard of the highest standards of the intellect and of morality. Although he has been taught to deal with things as they are, yet a large portion of his instruction has been devoted to things as they should be; and therefore when he starts in life he must adjust himself to life as it is. Whether this is a fault in that the training is not held within the limits of the practical may be an open question. But on the other hand, that a college education has the tendency to make one more humane, to broaden one's views of life, to make one more liberal, to quicken one's perception, to lend accuracy to the judgment, and insure more logical thinking, cannot be denied. FRANKLIN A. BECHER.

THE SYSTEM OF ALGOL.[1]

THE steady advance of exploratory research in the system of Algol promises to furnish one of the most curious and instructive episodes in the history of science. Vague hypothesis, determinate theory, and triumphant verification have already played their logically sequent parts in the discovery of the eclipsing satellite. Goodricke's conjecture, however, had to wait nearly a century for Pickering's formulization, while this was ratified within a decade by Vogel's disclosure of the anticipated tell-tale spectroscopic effects.

Progress has, indeed, of late notably quickened its pace; and we may therefore hope for a prompt and effective application of the Ithuriel-spear of adapted observation to the latest creation of speculative intelligence in the lately organized department of "dark stars." Since Argelander's time it has been tolerably evident that Algol had other attendants besides the agent in producing its periodical eclipses. For their recurrence was shown by him to be subject to minute irregularities in point of time, and these irregularities are of such a nature as to demand for their explanation the presence of at least one disturbing mass. A highly complex piece of mechanism could plainly be seen to be at work; yet the penetration of its intricacies presented a task so formidable that astronomers of, at any rate, the present generation might well have despaired of its accomplishment. It has, nevertheless, been undertaken by Dr. Chandler, and his labors have been rewarded with an encouraging measure of success.[2]

They have been necessarily of a more or less tentative character, and their result must be looked upon as merely provisional; but there is much reason to suppose that it at least approximates to the truth. It is, moreover, perfectly plain and straightforward; there is nothing of the *obscurum per obscurius* about it; the consequences it involves are definite, and admit of definite verification.

The new and enticing hypothesis now presented for the consideration of astronomers is mainly founded upon certain well-ascertained inequalities in Algol's period of variation. These were shown by Dr. Chandler's discussion some little time since[3] to be slowly compensatory. They are oscillatory, not progressive. Consistently in advance of their due time down to about the year 1804, the obscurations of the star then began to fall behind it, and the delay had accumulated in 1843 to 165 minutes. A gradual process of restoration thereupon set in, and the normal epoch was reached near the beginning of 1873. It was quickly, however, transcended, for acceleration is still going forward, and is likely to continue operative during some years to come.

These irregularities are evidently comprised in a cycle considerably exceeding one hundred years, and for that very reason it is difficult to account for them on gravitational principles; since a third body, exterior to the close pair, should, in order to produce any marked purturbational effects, revolve much nearer to them than would be consistent with so long a period. Another mode of explanation is, accordingly, resorted to by Dr. Chandler. The varying intervals needed for the transmission of light from different parts of a large orbit described by Algol and its dark satellite round a remote primary, are, in his view, the fundamental cause of the alternate anticipations and retardations in the occurrence of Algol's eclipses. They are, in fact, apparently shifted backwards and forwards in time, just in the same way as are the eclipses of Jupiter's satellites through the orbital movement of the earth. Algol may, then, be regarded as the solitary luminous number of a multiple combination of opaque masses. The common centre of gravity, round which the pair hitherto known revolves in a period of about 131 years, lies by the present hypothesis at a distance from it just equal to that of Uranus from the sun. The path thus traced out is, we are further informed, sensibly circular, and its plane is inclined 20° to our line of vision. Obviously, however, during the whole time occupied in travelling over its remoter half, the light-minima of the star must be recorded somewhat later than if we saw them in the precise order of their actual occurrence; and this remoter half was swept over between the years 1804 and 1869, when the observed phases were always in arrear of calculation. Now, on the other hand, that the star is on the hither side of its orbit, the epochs of its eclipses are apparently anticipated, and will not coincide with their true times until the passage of the "ascending node," about 1934. The dimensions of Algol's orbit, with its inclination, of course prescribe the amplitude of the oscillations by which its periodicity appears to be disturbed; and this "light equation," as we may call it, proves to be 149 minutes. This should be the maximum extent, whether of acceleration or of retardation; but in point of fact, as we have seen, delay mounted up in 1843 to 165 minutes. Hence the theory cannot be said to represent the observations as satisfactorily as could be desired. The deviations, indeed, are large enough to suggest to Dr. Chandler further complications, the unravelment of which may challenge the utmost skill and patience of investigators. Meantime, a touchstone of the general truth of his hypothesis will soon be at hand; for it involves a cessation within the next ten or twelve years, and a subsequent reversal of the shortening process at present affecting the star's period of luminous change; and the fulfilment of this prediction will serve as a hall-mark of its genuine quality. An additional test may be derived from the spectrographic evidence. The velocity of Algol in the large orbit attributed to it is 2.7 miles per second; but of this, less than one-half, or about one mile per second, is at present directed towards the earth. It constitutes, however, a goodly proportion of the 2.3 miles of continuous approach determined from the Potsdam plates; but which should in the course of a score of years, if the new theory be true, completely disappear, neutralized by the altered direction of the star's orbital motion. It remains,

[1] From Knowledge for May.
[2] Astronomical Journal, Nos. 255, 256.
[3] Ibid, vol. vii., pp. 165–183.

indeed, to be seen whether the whole of its supposed translatory speed may not really be of a circulatory character.

Dr. Chandler's theory does not rest wholly on the cyclical inequalities of Algol's light-changes. He alleges also in its support periodical disturbances of proper motion, brought to view by a careful discussion of all the observations of the star, from 1753 to the present time, and indicating, in his opinion, a combination of elliptical travelling with a progressive advance. But the average proper motion of Algol is so very small—less than 2″ of arc a century—that variations or irregularities in it can at present be regarded only as an interesting possibility. They would give, if confirmed, 2.7″ for the longest diameter of the ellipse into which the wide orbit traced out by Algol round its unseen primary is projected upon the sky. And since this little span represents an actual expanse of 38 earth-to-sun distances, or "astronomical units," it implies a parallax for the star of 0.07″, corresponding to a distance of nearly 47 light-years—a statement that is in many ways worth thinking about. Although claiming only qualified credence, it nevertheless conveys the upshot of assuredly the most promising attempt yet made to determine, by indirect means, the parallax of a star. In itself, too, it seems probable enough. Assuming its accuracy, we gain the information that Algol emits 63 times as much light as the sun, which, in its place, would show with little more than the brightness of a seventh-magnitude star. The famous variable, moreover, according to Dr. Vogel, is just one million miles in diameter, so that it presents only once and a third the solar radiating surface; yet it is, as a light-giver, 63 times more effective. The remarkable conclusion follows, that Algol is intrinsically 47 times more brilliant than the sun. The emissions from its photosphere are, per unit of area, 47 times more powerful. And should its parallax eventually—as seems not unlikely—prove to be smaller than 0.7″, this disparity will be still further enhanced.

By means, accordingly, of investigations of this nature, more fully and securely carried out, the question as to comparative stellar brilliancy may finally obtain a sufficiently satisfactory answer. It is a very important one. The process by which photospheric light is manufactured is still largely enigmatical, but the ideas commonly entertained about it are not easily compatible with the existence of considerable differences in the shining faculty of photospheric shells presumably identical in point of chemical composition. Reliable evidence of such differences has not hitherto been available. That light-power in stars bore no fixed proportion to mass was patent in numberless examples; but the density, consequently the dimensions of the emitting bodies remaining unknown, it could not be determined whether distension of substance, or innate strength of incandescence, was more concerned in producing a great sum-total of light relative to quantity of matter. The indications, however, now derived from Algol are overwhelmingly in favor of the latter alternative.

The primary member of its system, even if illuminated solely by the borrowed rays of its brilliant neighbor, may not, Dr. Chandler thinks, be out of reach of telescopic discovery. But his hopes, in this case, appear somewhat chimerical. It is not difficult to show that, under the circumstances supposed, a body of planitary constitution could not possibly be disclosed by any optical means at present available. Its position-angle relative to Algol is just now, we are told, 32°, while its distance from the same star is in the inverse ratio of its mass. This is considered by our author to be indeterminate; but it is not so, unless we reject Dr. Vogel's value for the combined mass of the close pair forming the variable. Assuming its approximate correctness, and that Algol and its immediate attendant accordingly contain two-thirds the solar quantity of matter, and admitting, further, that they revolve together, at a distance of nineteen astronomical units, in a period of 131 years, round their common centre of gravity with another body, it follows that the mass of that body is about equal to that of the sun, and that it circulates at twelve units of distance from the gravitational centre of the system. It should be found, this being so, if found at all, at an apparent interval of rather less than 2″ from Algol. The real gap of space separating them—the radius, that is to say, of Algol's relative orbit—would be measured by thirty-one radii of the earth's orbit; and the effectiveness for visual purposes of a still problematical body, shining by reflected light alone, can hence be estimated. If of the same density with Algol, it presents a disc of five-fold area, which, endowed with Jupiter's high reflective power, or an albedo of 0.62, would possess a total lustre $\frac{1}{2,680,000}$ that of the original source of its radiance. This is equivalent to saying that it should be fainter by sixteen stellar magnitudes. Yet the suppositions introduced above are perhaps unduly favorable to conspicuousness. Evidently, however, an eighteenth-magnitude star, in the close vicinity of one of the second, is far below discernment with any telescopic or photographic powers likely to be in use for a considerable time, if ever; so that visual confirmation of Dr. Chandler's theory can only be looked for if the unknown mass it has brought ideally into existence be in some degree self-luminous.

That theory, as he remarks, "has a much wider cosmological meaning than the mere explanation of the phenomena" of a single star. Most "eclipse-variables" exhibit irregularities of the same type with those of Algol, and which will doubtless prove amenable to a similar explanation. Moreover, an incalculable number of stars which, from our point of view, escape eclipse, unquestionably belong to systems organized on the same general plan. One such, indeed, is already known in α Virginis, a first-fruit of discovery in this particular branch; and Procyon, perhaps, is one of many others essentially resembling it, although inaccessible to spectrographic research, because revolving in planes nearly perpendicular to the line of sight. Thus the intimate association of dark and bright bodies of the same order of mass would appear to be no exception in the universal order. And this scarcely allows us any longer to regard a sun-like condition as representing simply and solely a stage in the condensation of a primitively nebulous mass. Some further conditions are plainly needed to produce the brilliant and concentrated evolution of light characteristic of "suns."

Dr. Chandler concludes his valuable paper with an appeal for micrometrical measures of Algol stars, adapted to detect and determine possible systematic disturbances of their proper motions. Measures of the kind might, in his opinion, lead to highly significant results, which would probably, in the case of Y. Cygni, be reached with particular promptitude. "If the research gave favorable results in this instance," our author continues, "it could then be extended to λ Tauri, which appears to be also a promising candidate." It is to be hoped that the suggestion will not remain unheeded. Owners of heliometers could hardly turn them to better account than by applying this simple criterion to an hypothesis which opens yet one more road through the daily widening field of sidereal discovery.

MISS A. M. CLERKE.

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THE CHANGE AT CORNELL.

THE resignation of Dr. Charles Kendall Adams, president of Cornell University, dated May 5, the acceptance of that resignation by the Trustees at a special meeting called for that purpose May 18, and the immediate election of Dr. J. G. Schurman, Dean of the Sage School of Philosophy at Cornell, to fill the vacancy thus arising at the end of the current college year, are events of supreme importance to that institution, and, we are inclined to think, to the cause of education, and especially of scientific and technical education, generally. President Adams states, as the reason for his withdrawal, that differences of opinion in matters of essential importance in the management of the institution divide the authorities, and finding himself out of harmony with the majority of the managing body—the local Executive Committee, presumably—he feels it his duty to turn the office over to the Trustees.

What are the details of these differences is not stated by him, nor are they publicly known, and conjecture in so important a matter is only harmful; it is sufficient that they must be radical, to bring about such a change. Meantime Dr. Adams has been at the head of that great University seven years, and has seen the most extraordinary development in the course of its always remarkable and striking history. It is to be sincerely hoped that the new administration will be equally fortunate with that just closing. The student-body has increased in these last seven years to between two and three times the number present the year before the accession of President Adams. New departments have been created, new schools formed, and the whole system of organization greatly changed, usually in the direction of advancement. The Trustees, in accepting the resignation, assert that the retiring officer has exhibited wisdom, knowledge, and admirable discretion in his choice of professors, as well as in his general management of affairs, and tender him a year's salary as a testimonial—a very practical one—of their indebtedness to him, and also request that he sit for his portrait as an addition to the gallery representing the already long list of benefactors of the University. He has certainly a most satisfactory period to review in his final report.

From correspondence in our columns, during the first year of President Adams's administration, and from other sources, we might have had reason to anticipate anything but satisfactory encouragement of Cornell's leading objects. Cornell, it will be remembered, is a "land-grant college" for technical education and sientific work. But the results do not at all encourage that idea. The scientific departments have continued strong, and have grown fully as rapidly as the classical and the literary; in fact, in some directions their growth has been even more extraordinary than that of the latter. The courses in arts and in civil engineering have substantially the same number of students; in architecture the growth has been continuous and rapid; and Sibley College, the departments of which are mainly devoted to instruction in the main lines prescribed by the foundation and by the founders of the University as a school of mechanical engineering and the mechanic arts, has gained, according to the figures of its monthly journal, one thousand per cent. In physics, and especially in the physics of engineering and of electric light and power distribution, and in chemistry, especially in chemistry applied in agriculture, the work performed in research as well as in instruction has attracted general attention, and has done much to place the University among the leading institutions of its class. Its leading objects have been promoted as remarkably as those presumably much nearer the heart of the outgoing president. There is, however, considerable discrimination against the technical courses at Cornell; the charges for tuition being about fifty per cent higher than in the general courses, and their progress has been the more remarkable for this fact. Whatever the reason for his surrender of his charge, there is no question that President Adams has the privilege of looking back upon a most enviable period of great opportunity well-availed of.

Dr. Schurman, the new president, is a very young man to carry such responsibilities— but 38 years of age; but he is reported to have the strength, the energy, and the good-temper of healthful youth, to be capable and even a genius in administration; to be in full sympathy with the work which his acceptance of the position pledges him to carry out in accordance with the terms of the Law of Congress, the Charter of the University, and the explicitly stated wishes of its greatest benefactors; and to be liberal enough to give satisfaction to the officers charged with the conduct of the principal departments of the University. He has the confidence of the Trustees, as was evident from their unanimous agreement in his selection; and it may probably be safely anticipated that Cornell will, under his administration, continue to grow with a rapidity only limited by the magnitude and permanence of her income. Like all great institutions of her class, she always has larger demands than her purse can meet, and her opportunities grow faster than her income. New York State is an exception to the rule in this matter. Nearly all the States, especially those west of New England, make permanent and liberal provision for their land-grant colleges; but New York has never, we understand, done anything for her now flourishing but yet needy State University. One of the opportunities of the Schurman administration may perhaps be the establishment of closer relations with the State, for which his charge is doing so much, and from which it is receiving so little.

HOW TO PROTECT INVENTIONS IN FOREIGN COUNTRIES WITHOUT EFFECT UPON THE TERM OF UNITED STATES PATENT.

ACCORDING to late articles in daily, and even certain electrical and other scientific papers, and according to current remarks of inventors, a prevalent idea seems to exist to the effect that it is detrimental to the inventor's interest to obtain foreign patents, because the duration of his domestic patent will be shortened. This inaccurate and misleading understanding of the law is employed as an argument in favor of the revision of the patent statute relating to the maximum and minimum terms of patents. The object of this article is not to argue concerning such a revision, but it may be stated that the writer is greatly in favor of revision, but would emphasize that misrepresentations of the present law will rather hinder than further revision. To say, in general, that a United States patent expires with the term of the patentee's foreign patent, is misleading, because it is true only in some instances. Such statements are made, and the conclusion arrived at by the ordinary inventor is such as to apparently convince him that foreign patents are very dangerous and had better be left alone.

It is probably impossible to compose one sentence which will convey the exact relations of the terms of patents, because of the multitude of variations or differences among the patent laws of the numerous countries in which inventions may be protected with profit. Classifications somewhat as follows will, it is thought, make the matter so plain that the ordinary inventor may easily use the same for reference, although he could not, probably, remember them very accurately from one reading. All important phases are set forth, because it is not enough to know simply the effect of foreign patents upon the term of the United States patent, but upon one another's terms. In order to be brief, the language is intended to be such as to convey concise and practical information to inventors, independently of historical developments, irrelevant conjectures as to future decisions, and other matters valuable only to the mere student and patent attorney.

In each list which follows, the countries are named alphabetically to facilitate reference.

The term 17 years of a United States patent is *not* shortened: —

By any simultaneous, or subsequent foreign patent;

Nor by a prior patent in Belgium, United States of Columbia, Liberia, or Spain, provided the foreign patent is not over three years old;

Nor by a prior caveat in Argentine Republic, British Guiana, British Honduras, Canada, Great Britain, Sandwich Islands, Leeward Islands, Queensland, Russia, South Australia, Switzerland, Tasmania, Trinidad, Victoria;

Nor by an application filed, within seven months of the United States application, in Belgium, France, Great Britain, Guatemala, Italy, Netherlands, Norway, Portugal, Servia, Spain, Sweden, Switzerland, and Tunis;

Nor by an application filed, within six months of the United States application, in Brazil or San Domingo.

The maximum amount of reduction of the term of a United States patent by a *prior* foreign patent is equal to the difference of the term of 17 years and that remaining term which the foreign patent has to run. The maximum terms of patents in foreign countries (leaving out those of longer term than 17 years) are: Argentine Republic, 15 years; Austria, 15 years; Barbadoes, 14 years; Brazil, 15 years; British Guiana, 14 years; British Honduras, 14 years; Canada, 15 years; Cape of Good Hope, 14 years; Ceylon, 14 years; Chili, 10 years; United States of Columbia, 10 years; Denmark, 5 years; Ecuador, 15 years; Fiji Islands, 14 years; Finland, 12 years; France, 15 years; Germany, 15 years: Great Britain, 14 years; Guatemala, 15 years; Sandwich Islands, 10 years; Hong Kong, 14 years; India, 14 years: Italy, 15 years; Jamaica, 14 years; Leeward Islands, 14 years; Luxumburg, 15 years; Mauritius, 14 years: Mexico, 10 years; Natal, 14 years; Newfoundland, 14 years; New South Wales, 14 years; New Zealand, 14 years; Norway, 15 years; Paraguay, 10 years; Peru, 10 years; Portugal, 15 years; Queensland, 14 years; Russia, 10 years; South Australia, 14 years; St. Helena, 14 years; Straits Settlements, 14 years; Sweden, 15 years; Switzerland, 15 years; Tasmania, 14 years; Trinidad, 14 years; Turkey, 14 years; Uruguay, 9 years; Venezuela, 15 years; Victoria, 14 years; West Australia, 14 years.

A valid patent is not obtainable in Ecuador, France, Germany, Leeward Islands, Luxumburg, Peru, Sandwich Islands, South Australia, Switzerland, Turkey, or Venezuela, after a prior patent has been issued in the United States, except in the case of France and Switzerland, under the condition that the application is filed within seven months after the United States application was filed.

A valid patent is obtainable, in Canada, if applied for within 1 year after issue of United States patent; in Italy, within 15 years; in Spain, within 2 years; in Argentine Republic, within 10 years; in Victoria, within 1 year; and in Western Australia, within 17 years.

In countries not named in the two paragraphs preceeding, valid patents are obtainable, as a general rule, if the inventions are not well known, or in use, within the territory of those countries.

From the foregoing facts, it is evident that, by planning the times of application, valid and useful protection may be obtained throughout the world without in any way shortening the full term in any country.

The point of law to be considered for revision, is the provision of a right of the American citizen to obtain a seventeen years' patent whether he has previously patented it abroad or not. EDWARD P. THOMPSON.

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.*

On request in advance, one hundred copies of the number containing his communication will be furnished free to any correspondent.

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

The General Circulation of the Atmosphere.

THE question concerning the origin of the winds, or the general circulation of the atmosphere, has been a perplexing one for many years, and is not yet completely and fully settled. There are so many factors entering into the question, that its solution is difficult to comprehend off-hand. Instead of a broad, flat plane, upon which idea some conclusions seem to be based, we have a globe, and the atmosphere is a complete envelope thereof, having almost the same spheroidal shape as the earth, upon which it rests. This envelope is made to adhere to the surface of the earth by means of gravitation, but not so rigidly that it may not be set in motion by the application of heat. The earth revolves on its axis daily, and the air revolves with it, although it does not always travel at the same rate.

A body of air at rest for some time, or moving only with a very slow motion, will soon acquire the direction of motion of those parts of the earth with which it comes in contact. When such a body of air moves to the north or south near the surface, it soon acquires an eastern or western component of motion; and if the same body of air returns as the upper strata, the eastern or western component of motion is reversed.

If the temperature of the entire body of atmosphere from pole to pole and from top to bottom, were the same, it is believed there would be no motion whatever of the air. Heat, therefore, or difference in the temperature, is the prime factor in the generation of air currents. It is maintained by some writers, however, that the rotation of the earth upon its axis, from the west to the east, would propagate a current of air, in the opposite direction, at or near the equator. But this has not been demonstrated to the satisfaction of all. So also it is believed that as aqueous vapor gives buoyancy to the air, this might produce some gentle breezes. As the sun is the source of all heat, we must look to that luminary as the producer of all winds and air currents. If the earth's surface were all water, or all land with a homogeneous topography, the air currents of the earth would remain almost constant and uniform. This continuity and uniformity are broken up and interfered with by the various divisions of continents, oceans, mountains, sandy plains, etc., and also by the variations of the temperature at the same locality at different periods in the year.

As the earth revolves upon its axis, one-half of its surface is always in the sunlight and the other half at the same time in darkness. The temperature of the former therefore is always higher than that of the latter; and the atmosphere tends to flow from the one to the other at the surface, and in the upper strata to flow in the opposite direction. This is in obedience to the known laws of dynamics: 1. That heated air will rise, and the vacuum which this tends to produce will be filled up by cold air flowing in at the bottom. 2. As gravity tends to keep the air in equilibrium, when a current of air is observed to be moving in any direction, either horizontally or perpendicularly, a like current will somewhere be found flowing in the opposite direction, to restore the equilibrium.

Let us liken the two hemispheres of air (one in the light and the other in the dark) to two great thin metallic cups or bowls, each enveloping one-half of the earth, their edges touching each other and coinciding with a great circle or meridian of longitude. Let them be pivoted at the poles, so that they may slide around the earth, one following the other. The one in the sunlight we will paint white, and the other black; and they follow each other as the earth revolves, the white being always turned towards the sun. Again, as the sun always shines perpendicularly to the earth's surface between the tropics, we find here a broad belt abnormally heated; and we will represent this heat on the white bowl by a broad band of bright red, and on the black bowl by a similar band of dark brown. Further, in examining the air along the edges of the two bowls, we find but little difference in the temperature of the two, the air growing colder as we recede from the edge towards the centre of the black, and warmer in the direction of the centre of the white bowl. We will therefore shade these edges, at first both nearly alike, but gliding into a dark gray, and then black towards one, and a light gray and then white towards the centre of the other. Still further, as the sun is annually perpendicular at each of the tropics, so the two poles will alternately be in light and shade — heat and cold. We must therefore give some slight shading to these parts of the bowls, to represent the different amounts of sun energy employed to heat the earth at these points.

We have now before us, therefore, most of the factors that enter into the production of air currents, or the circulation of the atmosphere. If the air could be seen with the naked eye, as we have here colored and shaded these two enveloping bowls, and if we could stand upon the moon or some inter-stellar planet and look upon the earth, what a grand and magnificent kaleidoscopic panorama would be presented to our view!

The theory of the general circulation of the atmosphere most generally accepted is shown in the following extract, taken from Buffon's "Natural History," which he quotes approvingly from Maclaren: "The unequal distribution of heat over the surface of the land and water necessarily disturbs the equilibrium of the atmosphere, and produces currents of air, or winds. These currents, however various, have been supposed to result from two general movements, pervading the whole mass of the atmosphere. The heavy and cold air of the temperate regions, having a tendency to displace the warm and rarified air of the torrid zone, generates a current in each atmosphere" (hemisphere?) "towards the equator. To replace the air abstracted from the higher latitudes, an upper and counter current flows back from the equator to the pole; and thus the atmosphere, while it performs a constant revolution, tempers the extremes of climate, by transporting the cold of the frigid zone to the equator, and carrying back the heat of the equator to the frigid zone." A writer on the article "Winds" in "Chambers's Encyclopædia" says: "When the part of the earth's surface which is heated is a whole zone, as in the case of the tropics, a surface wind will set in towards the heated tropical zone from both sides, and uniting will ascend, and, there separating, will flow as upper currents in opposite directions. Hence a surface current will flow from the higher latitudes towards the equator, and an upper current towards the poles." Professor William Ferrel, author of a "Popular Treatise on the Winds," published in 1889, practically adopts the above views. This is an elaborate work, containing about 500 pages, and is considered one of the best authorities on the subjects treated. In Chapter III., from page 89 to 162, he gives a detailed and graphic account of the "general circulation of the atmosphere." He frequently refers to the upper strata flowing "from the equator to the poles," and the surface currents flowing "from the poles to the equator," etc. On page 154 he gives a "graphic summary," as follows: "In the preceding part of this chapter it has been shown that if all parts of the atmosphere had the same temperature there would be a complete calm over all parts of the earth's surface. But that in consequence of the difference of temperature between the equatorial and polar regions of the globe, and the consequent temperature gradient, there arise pressure gradients and forces, which give rise to and maintain a vertical circulation of the atmosphere, with a motion of the air of the upper strata of the atmosphere from the equator towards the poles, and a counter current in the lower part from the poles toward the equator, as represented by the arrows in the following figure, and that this of course requires a gradual settling down of the air from the higher to the lower strata in the middle and higher latitudes, and the reverse in the lower latitudes. It has also been shown that, in case the earth had no rotation on its axis, this would be exclusively a vertical circulation in the planes of the meridians, without any east or west components of motion in any part; but that, in consequence of the deflecting forces arising from the earth's rotation, the atmosphere at the earth's surface has also an east component of motion in the middle and higher latitudes, and the reverse in the lower latitudes; and that the velocities of the east components increase with increase of elevation, so that, at great altitudes, they become very much greater than those at the earth's surface; while those of the west components decrease with increase of altitude up to a certain altitude, where they vanish and change signs and become east velocities, now increasing with increase of altitude to the top of the atmosphere."

Now the foregoing theory seems to me not to be sustained by the facts. It may seem presumptuous in a layman to question the conclusions of such great and confessed authorities; but if I am to follow what seems to me to be the truth, I must dissent. I have a profound admiration for the untiring labors and great researches of Professor Ferrel; he has placed the world under many obligations for his valuable suggestions; yet I fear he has fallen into the same error which has characterized the reasoning of all his predecessors. This is not strange or unexpected; for we all know that sometimes grave errors will for generations run through the writings of the most astute and learned men, undetected. Witness, for example, Lord Bacon's "Wisdom of the Ancients," where his "explanations" need explaining, and are more abstruse and muddled than the mythology of the Greeks and Romans. I do not know that what I may here offer as the true theory of the circulation of the atmosphere is new to the scientific world, as I have not kept full pace with all the new discoveries. I know, however, that it is not recognized by Professor

Ferrel, even by a reference; and if it had been proposed, before the publication of his book in 1889, I have full confidence that he would have known it, and either endorsed it or attempted to refute it. But no lover of truth should blindly follow any leader, however great; if his reasoning does not convince his understanding, he should mark out a course for himself, if that be to him the truth.

Any theory of the physical universe, or of any of its parts, which will account for the greatest number of known facts involved, will be most satisfactory and acceptable; and such theory will be held and entertained until another is discovered which will account for more, or all, of the facts.

Now any theory of the general circulation of the atmosphere may be accepted tentatively, as a true theory, which will fully explain and account for the following facts :—

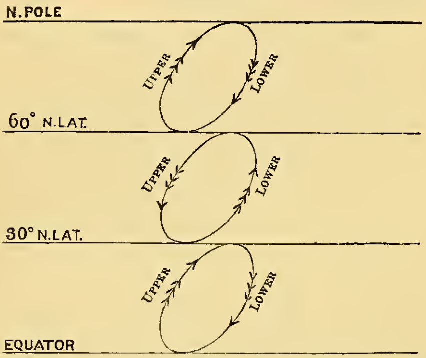
1. The trade-winds of the tropics.
2. The belt of calms at the equator.
3. The ascent of the trades to the upper strata at the equator.
4. Their flow as upper strata toward the temperate latitudes.
5. The belt of calms near the 30th parallel of north latitude.
6. The high barometric pressure at this calm belt.
7. The prevailing south-west winds in the north temperate zone.
8. The source of supply of the trades.
9. The source of supply of the constant (or prevailing) south-west winds in the north temperate latitudes.
10. The limit of range of the return trades of the tropics and the same limit of the upper strata in the north temperate latitudes.
11. The calm belt about the 60th parallel of north latitude, if there be one, as alleged by some writers.
12. The location of a calm at the north pole, if there be one, as Professor Ferrel believes.

Now it will require but slight reasoning to prove that a body of air starting from the equator can never reach the pole. Take, for example, the amount of air included between any two meridians of longitude; at the equator, the distance between these lines is about or near 70 miles. This body of air, as a return trade or upper current, starts moving toward the north. Concede for a moment that the earth does not rotate upon its axis. This air in its northern flight cannot veer to the right or left beyond these lines, for there is always another body of air there on either side to prevent it. As the meridians continually approach each other, and at the pole unite, it will be readily seen that if the air should ever reach the pole under these circumstances, it must be squeezed into space where there is no space. The length of the equatorial line is about 25,000 miles. The air starts all along this line to move northward simultaneously; can it keep on converging, until the entire 25,000 miles of air shall be forced into a space represented by a dot? It is physically impossible. A million cubic miles of air cannot be compressed into a pint cup. Conversely, a cubic foot of air can cover the north pole; if this amount should endeavor to reach the equator, it must, when it arrives there, expand to the extent of 25,000 miles. The theory of Professor Ferrel — the interchange between the poles and the equator — requires that the air at the earth's surface in all northern latitudes should move southerly with a western component of motion, similar to the trades; but the fact is, as everyone knows, and as he himself admits, that in the north temperate zone the surface winds move northward with an eastern component of motion; that is, from the south-west. This motion is shown by the arrows in the figure on page 155 of his book, referred to in the above quotation. Furthermore, the arrows in the same figure indicate that he would have the motion of all surface winds except the trades at the tropics, and all the upper strata, without exception, towards the east, the surface winds moving north-east, and the upper strata moving nearly east, but a little north of east; and he endeavors to prove this to be true, by elaborate reasoning and mathematical formulæ, extending over many pages. But this easterly motion of nearly the entire atmosphere is directly opposed by another principle which he recognizes on page 117, where he says: "This principle was recognized by Hadley in his theory of the trade-winds, for he states that *all motions* in any direction must have their counter-motions, else the effect upon the earth's surface would be to change the earth's rotation upon its axis." If it be objected that this reasoning is intended only to apply to surface winds, it may be stated that Professor Ferrel, on pages 93 and 94, seems to recognize the broad principle that *all* motions must have their counter-motions, which he terms the "condition of continuity." It is difficult to conceive how it is possible that all the upper strata, from pole to pole, should move in one direction, and that direction east, and so rapidly as to get ahead of the motion of the earth in its rotation upon its axis. Where are the counter-currents to all these easterly winds? Nowhere, except the surface trade-winds within the tropics. What force, what energy is it that causes all the winds to flow in one direction, and at so rapid a rate? What is their source of supply? and what is their limit of range or destination? Since their motion, as alleged, is not directly east, but a little north and south, in the respective hemispheres, of an east and west parallel, will they not ultimately fly off from the earth at the poles? The western component of motion of the trades, he says, is balanced by the corresponding eastern component of the winds in the more northern latitudes, and there is kept up and maintained his "condition of continuity," so far. But as there are no counter-currents alleged to correspond to the easterly motion of all the upper strata, it seems that his "condition of continuity" is thus destroyed.

Now to follow the air in all its motions, let us begin at the beginning of motion; that is, at the point where the greatest amount of energy is expended to produce motion,— at the equator,— and follow it in its flight, if we can. Here, as everyone can readily understand, the air is heated and rarified by the sun's rays, and rises up to the higher altitudes. This necessitates the inflowing of colder air from the north and south to prevent a vacuum. When the sun's energy has raised the column of air to the limit in height, it will then separate in two parts, one flowing north and one south, because of the descent of the temperature gradients in those directions. These motions and these causes are recognized by all authorities (except those who attribute everything to electricity), and we thus readily account for the trade-winds, the belt of calms at the equator, — the meeting of the two trades destroying motion, — the ascent of the trades to the upper strata, and their flow towards the temperate latitudes. As the subsequent motions of the atmosphere are similar in the two hemispheres, let us confine our further pursuit to those of the northern. When the upper stratum begins moving northward, it has acquired the eastern motion of the earth near the equator, and soon coming over portions of the earth with slower motion, it will get ahead of the earth and veer to the north-east,— making the return trades,— the cause being the reverse of that which produced the south-west motion of the trade-winds. As the parallels of latitude grow shorter and the meridians of longitude approach each other as we go north from the equator, it is evident that this body of air will soon become confined into narrower limits than it had at the equator; and it will sometime and somewhere happen that it will become so heaped up and crowded that its northern motion will be retarded, and finally cease entirely. When this happens, it will find the line of least resistance down towards the surface, where it will go to keep up the supply of the trades, and will then return to the equator again. So it may be inferred that this body of air will thus continue to make its eternal round in this grand cycle, unless changed from its course by local causes, topography, unequal distribution of temperature, etc. Its most northern limit is believed to be about the parallel of 30°, and its heaping up and downpour will cause both a calm and a high barometric pressure at this parallel.

Turning our attention next to the atmosphere in the north temperate latitudes, we discover that the air to the north of the above-named calm belt has a north-east motion at the surface of the earth. This eastern component of motion is doubtless produced by the same causes that operated to give a north-east motion to the upper strata of the tropics. When this body of air has proceeded for some distance to the northward, it will also be confined by the shortening of the parallels of latitude and the nearer approach of the meridians of longitude; and, thus meeting with resistance in front, it seeks the line of least resistance in the upper air, whither we follow it in an ascending current. It being perceived that its departure from the 30th parallel tended to produce a vacuum on that line, this current of air flows back again as upper strata in a south-west direction, obeying the same law which gives a western component of motion to the trades; when it reaches the parallel of 30° and then meets the other body from the equator, its further progress in that direction ceases, and it pours down to the surface and begins its circuit again. The northern limit of this motion is believed to be about the 60th parallel. So here we have another body of air, similar to that within the tropics, moving in a continuous circuit, but in opposite directions. For similar reasons, the atmosphere between latitude 60° and the pole will also move in a circuit between those points, only the direction of motion will be the reverse of that in the temperate zone. The coldest air in this northern zone being presumably at the pole, and therefore heaviest, will sink down to the surface and move southward with a western component, obeying the same laws heretofore given. When it reaches latitude 60°, it will meet the current from the south, rise to the upper strata, and flow back to the pole.

These several motions and the entire circulation in the northern hemisphere may be better understood by reference to the following figure: —



The arrows at the right hand show the direction of the surface flow, and those at the left indicate the direction of the upper strata, in the several zones.

It is to be understood, of course, that the foregoing theory is based upon the assumption of an earth with a homogeneous surface in both hemispheres; and that any variations from these results are due to differences of temperature, topography, etc. The existence of these three zones of air currents, with motions as here proposed, seems to furnish a full explanation of most of the facts known and observed up to date. That there is a belt of calms at the 30th parallel, and also a high barometer, seems to be so well established that no one can be found with the temerity to deny it. If there be an interchange of air between the poles and the equator, by a surface flow southward and upper strata flowing north, as proposed by Professor Ferrel and others, it seems impossible to explain the existence of this calm belt and high barometric pressure at parallel 30, or at any other place between the equator and the pole. The air flowing horizontally across any particular locality cannot produce a calm or a high pressure at that locality, whatever the velocity may be. A calm is produced by the meeting or parting of winds; a high pressure is produced by a down-pour, and a low pressure by an up-pour of the air.

So, also, the prevailing winds in the north temperate latitudes, from the south-west to the north-east, are so well established, that it is deemed no evidence is required here to prove their existence. Their direction and motion cannot be explained on Professor Ferrel's theory of a southward tendency of the air in that zone at the surface. A calm at the pole might be reasonably deducible from his theory; but one at the 60th parallel is impossible.

T. A. Bereman.

Mount Pleasant, Ia, May, 1892.

Four-Fold Space.

In the May 13 number of *Science*, I find a very interesting discussion of "The Possibility of a Realization of Four Fold Space," being a digest of a paper by Dr. T Proctor Hall. As I have not had the pleasure of reading Dr. Hall's paper, and as I have not read any fourth-dimensional literature for quite a while, what I am about to say may be old. If not, and you find it worthy of publication, you may use it.

All modern thinkers about the Kantian philosophy of the fourth dimension of space, have, I suppose, dipped more or less into Professor Zöllner's Transcendental Physics. It looks as if Dr. Hall had done so, as his discussion of the knotted-string question and the "plane being" as distinguished from an ordinary three-dimensional mortal, is quite similar to certain illustrations used by Professor Zöllner.

I think Dr Hall's idea of trying to get a clear concept of fourth-dimensional space, by initial projections from three-dimensional space, and then modifying those projections as best we can, is very ingenious, and may become a very useful factor in the study of the possibilities of four-dimensional space and four-dimensional beings; and I think he is entitled to great credit for his clear and effective start made in that direction.

I have only one criticism to make about it, which is that such a process would be exceedingly slow, as slow as the building up of the science of mathematics, or chemistry, or any other science which had to start with wholly unknown premises. I do not think that the study of four-fold space absolutely requires treatment of this elementary character. This opinion is based upon the following thoughts and inferences, which I have from time to time drawn with regard to this fourth dimension, and made use of in private conversation with regard thereto.

The so-called universe of matter, as has been repeatedly said, is known to us only because there is an unknown x (whether force or substance we cannot tell), which successfully resists our attempts to penetrate it, whether the attempt be made by the sight, the touch, or such power of projectile force as we think we have succeeded in bringing under our control. Outside of this resistance there is absolutely nothing but inference, an inference which some philosophers regard as amounting to conviction, and others, not.

When we say a block of granite is impervious or impenetrable, we simply announce an inference mentally drawn from impressions received by our various organs; and the point which I am now raising is simply this: that the same impressions might be received, and hence the same inference drawn, under a totally different state of affairs, provided we assume — and we have no reason for not assuming — that our standards, such as a foot of twelve inches, an inch of three barley-corns, etc., are simply relative, and compared with the infinite universe mean absolutely nothing, in other words, are not standards at all. Not to make this too long, but to illustrate hurriedly where I have thought, for some years, a starting point for the practical demonstration of four-dimensional space may be found, let me use an illustration.

Let us call our granite block a ten-foot cube. Standing in front of it we can only see one side; at a certain angle we can see two sides. From an elevated point we can see two sides and the top; but we can never see, except by the aid of reflectors, more than three of the six sides at once. We can easily walk around and under it, and see the other sides. In other words, and this is the key of the whole situation, we can see the whole of the cube successively but never simultaneously; and this applies to the inside as well as the outside. If this granite block were magnified so that each dimension was a thousand times what we have assumed it to be, it might be a very porous and loosely-jointed structure; yet if our eye were placed with increased faculties at a proper distance, the phenomenon presented to that eye would be exactly that which now shines forth in the ten-foot block of granite, and our inference as to its size and structure would be identical with our first assumption.

As we have no difficulty in believing that, owing to the revolution of the earth combined with its motion around the sun, we have been carried many miles through space in the fraction of a second which elapses, as we think, between dropping a coin and picking it up again, why should we regard it as an incredibly extravagant assumption that a correspondingly large space is unconsciously travelled over when we walk from one side to the other of our granite block? As the glimpse which we get of some of the fixed stars is merely a ray of light which has taken many hundred years to reach us, why should it be an altogether unreasonable assumption that the light-ray from our granite block may take a good deal longer to reach us than we are aware of? As we know, from experiments with birds, that there are sounds too high-pitched for our ear to detect, is it not in every way natural to expect that there are dimensions which the eye cannot detect?

To sum up: As our inferences with regard to the material world are rather the result of the limitations of our faculties than limitations of so-called matter itself, are we not likely to get ahead faster in the effort to broaden our concepts, and with them our ability to form concepts, by modifying our inferences than by trying to project our inferences into an unknown dimension?

W. P. Preble.

New York, May 23.

H. Carvill Lewis's Work on the Glacial Phenomena.

The following communication from the wife of the late Professor Lewis seems to me worthy of publication, both out of respect to the writer and for the considerable amount of valuable information which it contains upon a subject that is now uppermost in the minds of a considerable portion of the geological world. I have no doubt that a large circle of your readers will read it with great interest. G. F. Wright.

Oberlin, Ohio, May 23.

Professor G. Frederick Wright, LL.D.

Dear Sir: — Your valuable reprint from the *Journal of Science* for January, 1892, on "The Theory of an Inter-Glacial Submergence in England" was duly received this morning, and after a careful perusal of its contents I hasten to thank you for your courtesy in sending it.

The many questions relative to the causes and extent of the great glacial epoch have, with its accompanying phenomena, occupied a large share of my thoughts during the past twelve years, first, because of its surpassing interest and close connection with the solution of some of the most important physical and astronomical problems of the day; and, second, because I had the pleasure of sharing all my husband's ideas and plans and much of his field-work, from the day when he first made your acquaintance at the Boston meeting of the American Association, in August, 1880, to July 17, 1888, when, knowing the precarious nature of the malady which had attacked him, he gave all his unfinished manuscripts into my care, with the request, that, as I knew his inmost wishes in regard to them, I would see that they were all completed and published as they ought to be. The MS. for my husband's "Observations on the Glacial Phenomena of Great Britain"— so ably edited by the Rev. Dr. Crosskey of Birmingham, and covering 1,100 pages of foolscap, has been in Washington since July last awaiting publication. Had it been printed before the paper which you have so kindly sent me was written, I think you would have obtained a slightly different impression of my husband's later views from that expressed in the closing paragraphs.

As the importance of clear definition in scientific work of all kinds can hardly be overestimated, and as my husband's one wish was to learn the truth irrespective of theories, which he regarded merely as tentative hypotheses, to be thrown aside when they no longer served the purpose for which they had been constructed, I think that the term, "Correction of some of Professor Lewis's earlier working hypotheses," would give a clearer impression of the real state of the case than the phrase, "Correction of Professor Lewis's personal equation," which to the world in general implies a constant and known element of error in all that an observer sees or does, and which must be strictly accounted for in the sum-total of his work.

As no one could be more anxious than I am (except my husband himself) that all errors of whatever sort shall be promptly eliminated from his life work, and as I have only too good reason for knowing the endless and varied misconceptions with regard to his views, which have naturally arisen from the fragmentary reports of his European observations that have hitherto been published, I think that it may aid not only yourself but the scientific world generally if I send you a short synopsis of his later opinions. These are briefly as follows: —

With regard to the terminal moraine in Pennsylvania, over the last third of which he enjoyed the great pleasure and advantage of your companionship, his opinion remained unchanged, that a well-defined moraine had throughout the State defined the line of the solid ice-front.

The varying line of bowlders, scattered about as plums over a pudding, found considerably south of the moraine at different points in the western portion of the State, and which you both decided to name "The Fringe," he at first suggested (see Report Z) had been caused by a projection of the upper layers of ice — which move more rapidly than those beneath them — over the lower layers, which, as the ice rose hundreds of feet higher than the moraine at its base, would naturally and in accordance with its proper motion project the bowlders on the surface lying beyond the moraine line.

This view, however, was merely a tentative one, as he himself confessed (see Report Z), and he abandoned it in 1886, as his investigation of the English glacial deposits drew toward a close.

From many similar instances of "fringe" observed in Great Britain, and also in Switzerland and northern Italy, he was thoroughly convinced that the phenomena in each case that he himself examined had been caused by the damming back of streams flowing toward the ice-front and forming bodies of water of varying size and depth, which he called "extra-moraine lakes."

Full details and diagrams relating to his studies of these will be found in the forthcoming volume, and also his application of them to the phenomena observed in western Pennsylvania, where like features occur. The deposit of bowlders over the beds and along the edges of these extra-moraine lakes he held to be largely due to the drifting and melting of detached bergs, or cakes of ice, from the foot of the glacier, in which the *débris* had been frozen, or on whose surfaces the bowlders had been perched.

I do not remember my husband at any time thinking that "the fringe was the remnant of an earlier and distinct glacial period," though in the Old World he found in many places very clear evidence of there having been an advance or retreat, and a second advance of the isolated or coalescing streams, which together gave rise to the phenomena of the great glacial period.

I do, however, recall his frequent statement that never in any of his personal observations in America, Ireland, Great Britain, Switzerland, or Italy had he found a single instance of a glacier, ancient or modern, which had not at the time of its greatest extension been marked by a moraine at the foot of the solid ice, though these moraines often showed the greatest variety of form, from a low, flat deposit of gravel, sand, or till, from a few feet to a mile in width, and from a tiny ridge over which a man could easily step to the gigantic drift hills of northern Italy.

Exceptions to these observations occurred in cases where the ice moved from the land into the sea, as on the south side of the Killarney ice-centre, on the west side of the Clare Mountains, and in other instances, of which he himself has left a full description. The moraine in some portions of western England was much disturbed by the alternate elevation, depression, and re-elevation of that section of the country during the period of maximum glaciation, which caused a mingling and interbedding of morainic and marine deposits. Special stress should here be laid upon my husband's qualifying expression, "in my own experience," for he never at any time denied that a glacier ever had existed, did now exist, or could exist in the future without being bounded by a terminal moraine; he simply said, "I, personally, have been unable to find one."

With regard to your own admirable work in the State of Ohio, and beyond it toward the Mississippi valley, where the ice-front had not been marked by any definable moraine,— owing to its having gradually lost momentum and become very much attenuated in passing over a long, wide, and gently sloping plain till practically nothing remained of it,— my husband was fully prepared to accept the conclusions to which you had been led for that particular section of the country, as you will see from the notes appended to his English work.

In Ohio a set of conditions occur wholly unlike anything which my husband himself had seen in his glacial work, and making the allowance for a different glacial behavior, such as these conditions demanded, he felt that your own opinion with regard to them was the most logical he could reach at that time. In England, Wales, and Ireland a terminal moraine everywhere bounded the absolute ends of the separate or coalescing tongues of ice, except, as I have stated, where the ice had passed off to sea, or the moraine deposits had been disturbed by contemporary or subsequent water action, of which, in either case, there was always more or less distinct evidence. The moraine lines mentioned in your paper are all given in full in my husband's sketch of "The Terminal Moraines of the Great Glaciers of England," published for the Meeting of the British Association in Manchester in September, 1887; and his later opinions as to the origin of the "fringe" will be found in a similar article on "Some Great Extra-Morainic Lakes in England and North America at the Time of Maximum Glaciation."

My husband distinctly held that the maximum submergence in the West of England had attained a depth of from 450 to 500 feet, but had not reached that of 1,000 feet or more, as claimed by some of the leading British geologists.

Another point to be emphasized is that in my husband's mind a terminal moraine showed the halting-place of the solid ice only at the time of its greatest extension, and did *not* define or limit the irregular drift-covered areas in many instances found lying beyond it, which were due to the action of drainage-streams, icebergs or the deposits in temporary lakes.

As I have elsewhere stated, the first and only instance my husband ever saw which led him to believe in the existence of a large ice-stream (whether local or otherwise remains to be determined), between which and the glacial epoch as vast an interval of time had elapsed as that which separates the glacial period from the present day, was found in the deposits on Frankley Hill, near Birmingham. It was his intention, had he remained in this world, to make a thorough re-examination of all England, lest similar deposits had elsewhere escaped his notice; but he never at any time associated the Frankley Hill till and gravel with the "fringe" of the glacial period, from which it was wholly distinct.

Permit me to say in closing that the unlimited courtesy and generosity shown me by Dr. Crosskey and many others among the English geologists—some of whom are entirely opposed to my husband's conclusions—are beyond all praise and any acknowledgment which it is in my power to give. If, when I have in future to turn to my own countrymen for aid in finishing my husband's MSS. relating to the geology of the New World, I experience even a fraction of the kindness which has surrounded me in England, I shall have nothing left to desire.

CALENDAR OF SOCIETIES.

Philosophical Society, Washington.

May 21.—H. A. Hazen, Scientific Ballooning; Alexander S. Christie, The Method Employed to Find the Latitude-Variation Tide.

Publications Received at Editor's Office.

ABBOTT, LYMAN. The Evolution of Christianity. Boston, Houghton, Mifflin & Co. 12°. 266 p. $1.25.

BAILEY, L. H. Cross-Breeding and Hybridiging. New York, Rural Pub. Co. 12°, paper. 44 p. 40 cts.

HOLBROOK, M. L. The Hygienic Treatment of Consumption. New York, M. L. Holbrook & Co. 12°. 219 p.

LYDEKKER, R. Phases of Animal Life Past and Present. New York, Longmans, Green & Co. 12°. 248 p. $1.50.

NEW JERSEY. Annual Report of the State Geologist for 1891. Trenton, J. L. Murphy Pub. Co., printers. 8°, paper. 270 p.

Exchanges.

[Free of charge to all, if of satisfactory character. Address N. D. C. Hodges, 874 Broadway, New York.]

Taxidermist going out of business has quantity of finely-mounted specimens of North American birds, mammals and reptiles and skins of birds for sale, including a full local collection of bird skins, showing some great variations of species; also quantity of skulls with horns of deer and mountain sheep, and mounted heads of same. Will give good exchange for Hawk Eye camera with outfit. Apply quickly to J. R. Thurston, 265 Yonge St., Toronto, Canada.

For exchange.—A fine thirteen-keyed flute in leather covered case, for a photograph camera suitable for making lantern slides. Flute cost $27, and is nearly new. U. O. COX, Mankato, Minn.

To exchange; Experiment Station bulletins and reports for bulletins and reports not in my file. I will send list of what I have for exchange. P. H. ROLFS, Lake City, Florida.

Finished specimens of all colors of Vermont marble for fine fossils or crystals. Will be given only for valuable specimens because of the cost of polishing. GEO. W. PERRY, State Geologist, Rutland, Vt.

For exchange.—Three copies of "American State Papers Bearing on Sunday Legislation," 1891, $2.50, new and unused, for "The Sabbath," by Harmon Kingsbury, 1840; "The Sabbath," by A. A. Phelps, 1842; "History of the Institution of the Sabbath Day, Its Uses and Abuses," by W. L. Fisher, 1859; "Humorous Phases of the Law," by Irving Browne; or other works amounting to value of books exchanged, on the question of governmental legislation in reference to religion, personal liberty, etc. If preferred, I will sell "American State Papers," and buy other books on the subject. WILLIAM ADDISON BLAKELY, Chicago, Ill.

For Sale or Exchange for books a complete private chemical laboratory outfit. Includes large Becker balance (200g. to 1-10mg.), platinum dishes and crucibles, agate motors, glass-blowing apparatus, etc. For sale in part or whole. Also complete file of *Silliman's Journal*, 1862-1885 (62-71 bound); Smithsonian Reports, 1854-1883; U. S. Coast Survey, 1854-1869. Full particulars to enquirers. F. GARDINER, JR., Pomfret, Conn.

Wanted, in exchange for the following works, any standard works on Surgery and on Diseases of Children: Wilson's "American Ornithology," 3 vols.; Coues' "Birds of the Northwest" and "Birds of the Colorado Valley," 2 vols.; Minot's "Land and Game Birds of New England;" Samuels' "Our Northern and Eastern Birds;" all the Reports on the Birds of the Pacific R. R. Survey, bound in 2 vols., morocco; and a complete set of the Reports of the Arkansas Geological Survey. Please give editions and dates in corresponding. R. ELLSWORTH CALL, High School, Des Moines, Iowa.

To exchange Wright's "Ice Age in North America" and Le Conte's "Elements of Geology" (Copyright 1882) for "Darwinism," by A. R. Wallace, "Origin of Species," by Darwin, "Descent of Man," by Darwin, "Man's Place in Nature," Huxley, "Mental Evolution in Animals," by Romanes, "Pre-Adamites," by Winchell. No books wanted except latest editions, and books in good condition. C. S. Brown, Jr., Vanderbilt University, Nashville, Tenn.

Wants.

Any person seeking a position for which he is qualified by his scientific attainments, or any person seeking some one to fill a position of this character, be it that of a teacher of science, chemist, draughtsman, or what not, may have the 'Want' inserted under this head FREE OF COST, *if he satisfies the publisher of the suitable character of his application. Any person seeking information on any scientific question, the address of any scientific man, or who can in any way use this column for a purpose consonant with the nature of the paper, is cordially invited to do so.*

WANTED.—By a young man, a Swarthmore College junior, a position as principal of a public high school in one of the Gulf States, or as instructor in botany, physiology, and geology in an academy or normal school. Address B., care of Librarian, Swarthmore College, Penn.

WANTED.—A teacher of Geology who is familiar with the fossils of the Hamilton Group, as instructor of Geology during July next at the Natural Science Camp on Canandaigua lake. Apply to ALBERT L. AREY, Director, 229 Averill Ave., Rochester, N. Y.

WANTED.—To act as correspondent for one or two daily or weekly papers. Have worked on paper for about two years Would like a position on editorial staff of humorous paper. Address GEO. C. MASON, 14 Elm St., Hartford, Conn.

TRANSLATOR wanted to read German architectural works at sight (no writing). One familiar with technical terms desired. Address "A.," Box 149, New York Post Office.

WANTED.—A position in a manufacturing establishment by a manufacturing Chemist of inventive ability. Address M. W. B., care of *Science*, 874 Broadway, N. Y.

WANTED.—Books on Anatomy and Hypnotism. Will pay cash or give similar books in exchange. Also want medical battery and photo outfit. DR. ANDERSON, 182 State street, Chicago, Ill.

WANTED.—A college graduate with some normal training, to teach the sciences, at $1,800 per year, in a Southern college. A Baptist or a Methodist preferred. Must also be a first-class Latin scholar. A. H. Beals, Box K, Milledgeville, Ga.

A PROFESSORSHIP in Chemistry is wanted by one who has had five years' experience in that capacity. Would prefer to give instruction by lectures and experiments rather than by text-book methods. Would like a position in a college or university where there is a good student's laboratory. Special points of strength claimed are: (1) Thorough control of a class and good order during lectures and recitations. (2) Accuracy in experimenting with chemicals and skill in the manipulation of chemical apparatus. The permission of several distinguished educators has been given to refer to them if required. Would not care to accept a position paying less than $1,500. Address B. E., care of *Science*, 874 Broadway, New York.

ADDRESS WANTED.—Will some one please send the address of the Secretary of the American Philological Society. Also that of Herbert Spencer. "ADDISON," Room 84, 164 Madison St., Chicago, Ill.

As the publication of this letter may serve to elucidate my husband's views and to explain what his exact position was with regard to the leading questions of the day in glacial geology, pending the publication of his own work, I shall be greatly indebted if you will insert it at such a place in your detailed defense of his views as your own greater wisdom shall direct.

Again thanking you for your interesting and valuable paper, believe me to be, with regard,

Faithfully yours,

JULIA F. LEWIS.

Hotel Lang, Heidelberg.

AMONG THE PUBLISHERS.

THE fourth number of the "Columbia College Studies in Political Science," completing the first volume of that series of monographs, is entitled "The Financial History of Massachusetts from the Organization of the Massachusetts Bay Company to the American Revolution," by Charles H. J. Douglas, Ph.D., Seligman Fellow in Political Science in Columbia College. Doctor Douglas, before he returned East some four or five years ago to take charge of the work in history and English literature in the Brooklyn Boys' High School, was proprietor and managing editor of the *University*, a weekly literary and critical journal of Chicago, since merged in *Unity*, the well-known liberal religious weekly of that city. The *University*, during the two or three years of its separate existence, gained a high position as an independent medium of scholarly discussion. Besides Doctor Douglas, then an instructor in the University of Wisconsin, its editorial staff included the late Professor Alexander Winchell, of the University of Michigan; Professor William H. Payne, now chancellor of the University of Nashville; Professor Charles K. Adams, lately president of Cornell University, and Professor George W. Knight, now of the Ohio State University, all of whom contributed to each number. Complete volumes of the *University* are now excessively rare.

—The next annual meeting of the Royal Society of Canada will be held at Ottawa on May 31 and following days, and will be opened with the usual inaugural address by the President, the Reverend Abbé Laflamme. Amongst the papers to be presented the following are of scientific interest: In the section of English literature a vocabulary of the language of the Beorhicks, or Red Indians of Newfoundland, by the Rev. Dr. Patterson, and a grammar and dictionary of the language of the Haida Indians of the Queen Charlotte Islands, by Rev. Chas. Hamilton of British Columbia; in the Physical section, "The Fundamental Hypothesis of Abstract Dynamics," by Professor J. G. MacGregor; "Long Columns," by Professor Bovey; and "On a New Form of Application Goniometer," by Professor Chapman; and in the Geological and Biological section, "The Fossils of the Hudson River Formation in Manitoba," by J. F. Whiteaves, and "On the Correlation of Early Cretaceous Floras in Canada and the United States, and on Some New Plants of this Period," by Principal Sir William Dawson.

TO THE READERS OF SCIENCE.

PUBLISHER'S ANNOUNCEMENT.

OUR PLANS.

WITHIN the past six months the use of *Science* by scientific men and women as a medium for prompt publication and weekly discussion, has increased very materially, so that the pages are now well filled each week with original matter. As the number of those promising contributions is increasing at the rate of three cr four each day, it cannot be long before *Science* at its present size will be too small for the amount of matter offered. We have under consideration therefore an enlargement of the paper by one-half, but must first learn the temper of our constituency as to an advance in price to $5.00, which was the subscription price from the start for four years, up to June 30, 1887. Further, to carry out the proposed enlargement, we shall need five hundred additional subscribers. If you are not already a subscriber, are you willing to aid in making *Science* more worthy of American scientific work by becoming one?

It goes without saying, that the demand for scientific literature is limited, when compared with that for literature which is more to the public taste, so that the receipts of most of the Scientific Journals, in this country, do not pay quite for their printing and paper, to say nothing of the other items of expense. We say this merely to emphasize the fact, that generous and prompt support must be accorded this move if it is to succeed.

Titles of Some Articles Published in *Science* since Jan. 1, 1892.

Aboriginal North American Tea.
Actinism.
Amenhotep, King, the tomb of.
Anthropology, Current Notes on.
Arsenical Poisoning from Domestic Fabrics.
Anatomy, The Teaching of, to Advanced Medical Students.
Astronomical Notes.
Botanical Laboratory, A.
Brain, A Few Characteristics of the Avian.
Celts, The Question of the.
Collection of Objects Used in Worship.
Deaf, Higher Education of the.
Diphtheria, Tox-Albumin.
Etymology of two Iroquoian Compound Stems.
Eye-Habits.
Family Traits, Persistency of.
Fishes, The Distribution of.
Fossils, Notice of New Gigantic.
Grasses, Homoptera Injurious to.
"Healing, Divine."
Hemiptercus Mouth, Structure of the.
Hypnotism among the Lower Animals.
Hypnotism, Traumatic.
Indian occupation of New York.
Influenza, Latest Details Concerning the Germs of.
Infant's Movements.
Inventors and Manufacturers, the American Association of.
Iowa Academy of Sciences.
Jargon, The Chinook.
Klamath Nation, Linguistics.
Lightning, The New Method of Protecting Buildings from.
Lissajou's Curves, Simple Apparatus for the Production of.
Maize Plant, Observations on the Growth and Chemical Composition of.
Mineral Discoveries, Some Recent, in the State of Washington.
Museums, The Support of.
Patent Office Building, The.
Pocket Gopher, Attempted Extermination of.
Psychological Laboratory in the University of Toronto.
Psychological Training, The Need of.
Rain-Making.
Rivers, Evolution of the Loup, in Nebraska.
Scientific Alliance, The.
Star, The New, in Auriga.
Storage of Storm-Waters on the Great Plains.
Teaching of Science.
Tiger, A New Sabre-Toothed, from Kansas.
Timber Trees of West Virginia.
Tracheæ of Insects, Structure of.
Vein-Formation, Valuable Experiments in.
Will, a Recent Analysis of.
Wind-Storms and Trees.
Wines, The Sophisticated French.
Zoology in the Public Schools of Washington, D. C.

Some of the Contributors to *Science* Since Jan. 1, 1892.

Aaron, Eugene M., Philadelphia, Pa.
Allen, Harrison, Philadelphia, Pa.
Baldwin, J. Mark, University of Toronto, Canada.
Barnes, Charles Reid, Madison, Wis.
Baur, G., Clark University, Worcester, Mass.
Beal, W. J., Agricultural College, Mich.
Beals, A. H., Milledgeville, Ga.
Beauchamp, W. M., Baldwinsville, N.Y.
Boas, Franz, Clark University, Worcester, Mass.
Bostwich, Arthur E., Montclair, N.J.
Bradley, Milton, Springfield, Mass.
Brinton, D. G., Philadelphia, Pa.
Chandler, H., Buffalo, N.Y.
Comstock, Theo. B., Tucson, Arizona.
Cragin, F. W., Colorado Springs, Col.
Davis, W. M., Harvard College, Cambridge, Mass.
Dimmock, George, Canobie Lake, N.H.
Farrington, E. H., Agricultural Station, Champaign, Ill.
Ferree, Barr, New York City.
Flexner, Simon, Johns Hopkins University, Baltimore, Md.
Foshay, P. Max, Rochester, N.Y.
Gallaudet, E. M., Kendall Green, Washington, D.C.
Garman, S., Museum of Comp. Zool., Cambridge, Mass.
Golden, Katherine E., Agricultural College, Lafayette, Ind.
Hale, Edwin M., Chicago, Ill.
Hale, George S., Boston, Mass.
Hale, Horatio, Clinton, Ontario, Canada.
Hall, T. Proctor, Clark University, Worcester, Mass.
Halsted, Byron D., Rutgers College, New Brunswick, N.J.
Haworth, Erasmus, Oskaloosa, Iowa.
Hay, O. P., Irvington, Ind.
Haynes, Henry W., Boston Mass.
Hazen, H. A., Weather Bureau, Washington, D.C.
Hewitt, J. N. B., Bureau of Ethnology, Washington, D.C.
Hicks, L. E., Lincoln, Neb.
Hill, E. J., Chicago, Ill.
Hill, Geo. A., Naval Observatory, Washington, D.C.
Hitchcock, Romyn, Washington, D.C.
Hotchkiss, Jed., Staunton, Va.
Howe, Jas. Lewis, Louisville, Ky.
Hubbard, Gardiner G., Washington, D.C.
James, Joseph F., Agricultural Dept., Washington, D.C.
Johnson, Roger B., Miami University, Oxford, O.
Kellerman, Mrs. W. A., Columbus, O.
Kellicott, D. S., State University, Columbus, O.
Macloskie, G., Princeton, N.J.
McCarthy, Gerald, Agricultural Station, Raleigh, N.C.
MacDonald, Arthur, Washington, D.C.
Marshall, D. T., Metuchen, N.J.
Mason, O. T., Smithsonian Institution, Washington, D.C.
Nichols, C. F., Boston, Mass.
Nuttall, George H. F., Johns Hopkins University, Baltimore, Md.
Oliver, J. E., Cornell University, Ithaca, N.Y.
Osborn, Henry F., Columbia College, New York City.
Osborn, Herbert, Agricultural College, Ames, Iowa.
Pammel, L. H., Agricultural Station, Ames, Iowa.
Pillsbury, J. H., Smith College, Northampton, Mass.
Ruffner, W. H., Lexington, Va.
Schufeldt, R. W., Washington, D.C.
Scripture, E. W., Clark University, Worcester, Mass.
Slade, D. D., Museum Comp. Zool., Cambridge, Mass.
Smith, John B., Rutgers College, New Brunswick, N.J.
Stevenson, S. Y., Philadelphia, Pa.
Stone, G. H., Colorado Springs, Col.
Thurston, R. H., Cornell University, Ithaca, N.Y.
Todd, J. E., Tabor, Iowa.
True, Frederick W., National Museum, Washington, D.C.
Turner, C. H., University of Cincinnati, Cincinnati, O.
Ward, F. DeC., Harvard University, Cambridge, Mass.
Ward, Stanley M., Scranton, Pa.
Warder, Robert B., Howard University, Washington, D.C.
Welch, Wm. H., Johns Hopkins University, Baltimore, M.D.
West, Gerald M., Clark University, Worcester, Mass.
Williams, Edward H., Lehigh University, Bethlehem, Pa.

SCIENCE

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SCIENCE

NEW YORK, JUNE 3, 1892.

AN ARCHITECTURAL SCHOLARSHIP FOR PHILADELPHIA.

THE attempt now being made in Philadelphia to found an Architectural Travelling Scholarship in connection with the University of Pennsylvania is a most interesting incident in architectural education. The value of travelling scholarships for study abroad has long been recognized in the older architectural schools of the country. Boston has two, and so has New York, in both of which cities they form not only the richest prizes for the student, but are the climax to the scheme of education. In Philadelphia rather a different tack has been taken. Though the Architectural School of the University of Pennsylvania is one of the youngest in the country, it has, within a few years, become so firmly established as to be able to make an appeal to the people of Philadelphia for the endowment of this most important enterprise.

The success of this movement will mean much more than the addition of one more attraction to the already rich list brought to the University through the energy and tact of the provost, Dr. William Pepper. Important as it is for the future of the architectural school, it is much more important in indicating a new and healthy growth of architectural appreciation in a city which has long been a by-word among architectural critics. However great may be the merits of some Philadelphia buildings, its architecture, as a whole, is much below the standard of other American cities. That the large amount necessary to found a Travelling Scholarship should be raised there, shows an increased appreciation of the æsthetic side of architecture, which the buildings of the city scarcely indicate. This movement, however, shows that at foundation the status of Philadelphia architecture has been greatly underestimated. It shows that, though Philadelphia architecture may not always be what it should be, the architectural ideas prevalent in that city are just what might be expected in any cultured community. It shows an interest in the art that will work wonders in determining the future architectural standing of the city.

And this is what the scholarship is hoped to accomplish, though in another way. Limited to draughtsmen of Philadelphia and Pennsylvania, the year devoted to foreign study cannot but be highly beneficial to the city and State. The training in the architectural schools is wholly preliminary to professional work. Unlike the medical schools, they do not undertake to turn out finished graduates, ready for business, and prepared to design great monuments of art and genius. The architectural graduate, on leaving his school, is only prepared to begin his professional studies. Not only has his preliminary work been directed towards this point, but it has afforded him perhaps the only opportunity in his life to become acquainted with the relative merits and forms of every style of architecture. Every day architects are specializing their work more and more, and limiting their activity to some one particular style, or perhaps to some one phase of a style. The draughtsman in the office has, therefore, no opportunity to become acquainted with any style save that upon which his employer is engaged. His ideas centre in one direction; like the partly-educated man, his horizon is limited, and possibly in the most unfortunate manner.

It is here the value of the school training in the history of architecture comes in, for by this means the student is enabled to review the entire history of architecture under an intelligent and unprejudiced guide. He does not learn to design in every style,— at least he should not,— he does not learn the minutiæ of every school, nor practise eclecticism, the most barbarous of all architectural sins. He is simply storing his mind with images of great and beautiful buildings, just as the student of literature — to make a somewhat unnecessary comparison — stores his mind with the beautiful thoughts and styles of the master poets. Now if to this is added a year of foreign study, in which the best architectural products of man can be studied in the monuments themselves, in which practical problems of great magnitude can be seen in their actual solution, in which the realities of architecture can be appreciated in a more real manner than is possible from photographs and descriptions, and the students see and study architecture in its monumental aspect, the benefits from such a course may be readily seen. There results a broadening of mind, and a keener appreciation of architectural art than can be had by other means. This is the value of architectural travelling scholarships, and this is why the movement by the University of Pennsylvania means so much for that city and the State.

It must not be inferred that study abroad will make dreamers of our architects, or instil foreign ideas in place of native conceptions. We may not build cathedrals or palaces or great monumental structures, but these edifices show how very great architecture can be, and illustrate methods and forms which can be studied in no other way. Refreshed from a study of foreign architecture, the American student is better able to grasp the conditions which surround the art at home. He has seen what architects in ages less rich in knowledge and mechanical appliances have accomplished, and though his own problems may be different, the example of former work spurs him on to better attempts. We hear a good deal about American art for Americans, and the futility of sending American artists to Paris to study. Fortunately, we hear less of this than formerly, and we shall hear less as the value of foreign study is appreciated. There is no cry for American architecture for America, but the value of foreign study to the architect is quite as valuable, quite as useful, quite as necessary, as it is to the painter or the sculptor. A year abroad is not for the purpose of learning how to copy foreign buildings, but to see and study architectural masterpieces. To borrow a previous illustration, the student of literature does not study Shakespeare with the hope or thought of imitating him, but of gaining some helpful insights into the masterpieces of literature. It is on this principle the architectural scholarships are founded. And it is on this the University of Pennsylvania makes its appeal for a Travelling Scholarship. BARR FERREE.

New York.

ARTESIAN WELLS IN IOWA.

THE demand for artesian waters in the State of Iowa is not to be connected with unfavorable climatal conditions. The State is well watered; a considerable number of rather large streams and innumerable smaller ones combine to make it, from a hydrographic standpoint, unique among prairie States. The annual rainfall is a little more than thirty-five inches, and chiefly comes at a time of year when every crop-necessity is fully supplied. The main grounds upon which artesian waters are sought, therefore, are, first, the convenience of such flows for farm and urban use, and, second, the supposed purity of such waters. These are the prime reasons which have induced exploratory drilling, the chief results of which it is the purpose of this notice to record.

About four-fifths of the area of Iowa has now been demonstrated to possess artesian conditions. Most of this area lies northward of a line which may be drawn across the State, in a north-westerly direction, from near Keokuk to Sioux City, except in the igneous area indicated below. South of this somewhat arbitrary line but one or two artesian flows are known; these appear to be connected with the Nebraska artesian area, and are in the immediate neighborhood of the cities of Omaha and Council Bluffs. By reference to the sketch-map accompanying, it will be seen that the greater number of the wells lie along the DesMoines River or its tributaries; this distribution, which is well marked, is to be correlated with the distribution of the great terminal moraine, within which most of these wells are situated. This peculiarly interesting feature is further discussed beyond. The very deep and permanent artesian wells lie mainly east and north of the line above mentioned; or, better still, east of a line drawn north and south through the city of Ottumwa, No. 169 on the map. With but a single exception, that at Washington, No. 54 of the map, these deeper borings furnish abundant flows of water. But there are also, east of this north and south line, two smaller areas of shallow wells whose characters are essentially identical with those exhibited by the wells within the terminal moraine. One of these lies along the Iowa River (see map, Nos. 60–66, etc.); the other, and by far the smallest single artesian area in the State, is in the valley of the Wapsipinnicon River, in Bremer County (see map, Nos. 11, 12, and 42). The shallow wells, therefore, constitute well-defined groups; the deep wells are widely scattered.

It has been found convenient to classify the Iowa artesian wells in terms of the geological structure which they exhibit. To the shallow wells, those that form groups and which present similar geological sections, the term "glacial wells," or wells of the first class, has been applied. To all others, no matter what may be the geological age of the strata into which they may pass or in which they end, the term "deep wells," or wells of the second class, may be appropriated. There is no distinguishing mnemonic on the map, by which these wells may be differentiated.

A few important deep borings have been made, in various parts of the State, but more particularly in the north-western and south-western portions, in which artesian waters were not found. But, in the greater number of these borings, the water rose to constant heights, always, however, some distance below the top of the boring. These are called on the map "deep wells not artesian," and are indicated by a specific mnemonic, as in the Glenwood well, in south-western Iowa (see map, No. 120).

In depth the glacial wells range from forty feet to two hundred and fifty feet in a few cases; this feature is dependent on the relations of the borings to pre-glacial drainage, on the one hand, and to the thickness of the morainic materials, which is a variable, on the other. A generalized section may be given as follows from the sequence disclosed in Hancock and Wright Counties: —

Soil	1–5 feet.
Bowldery clay, with water	10–50 feet.
Bluish, bowldery glacial clays	30–12 feet.
Sand and gravel	8–20 feet.
Sand and gravel, with water	15–25 feet.

These materials are irregularly distributed over the surface of the State, and exhibit a variable relation. However, whenever the gravels and sands of the lower series are reached, especially in the valleys of the larger streams within the terminal moraine, flowing wells are likely to be obtained.

The deeper artesian wells, or those which present the characteristic feature of penetrating the country rock, are typified by the following section, which is that of the deep artesian well at Cedar Rapids: —

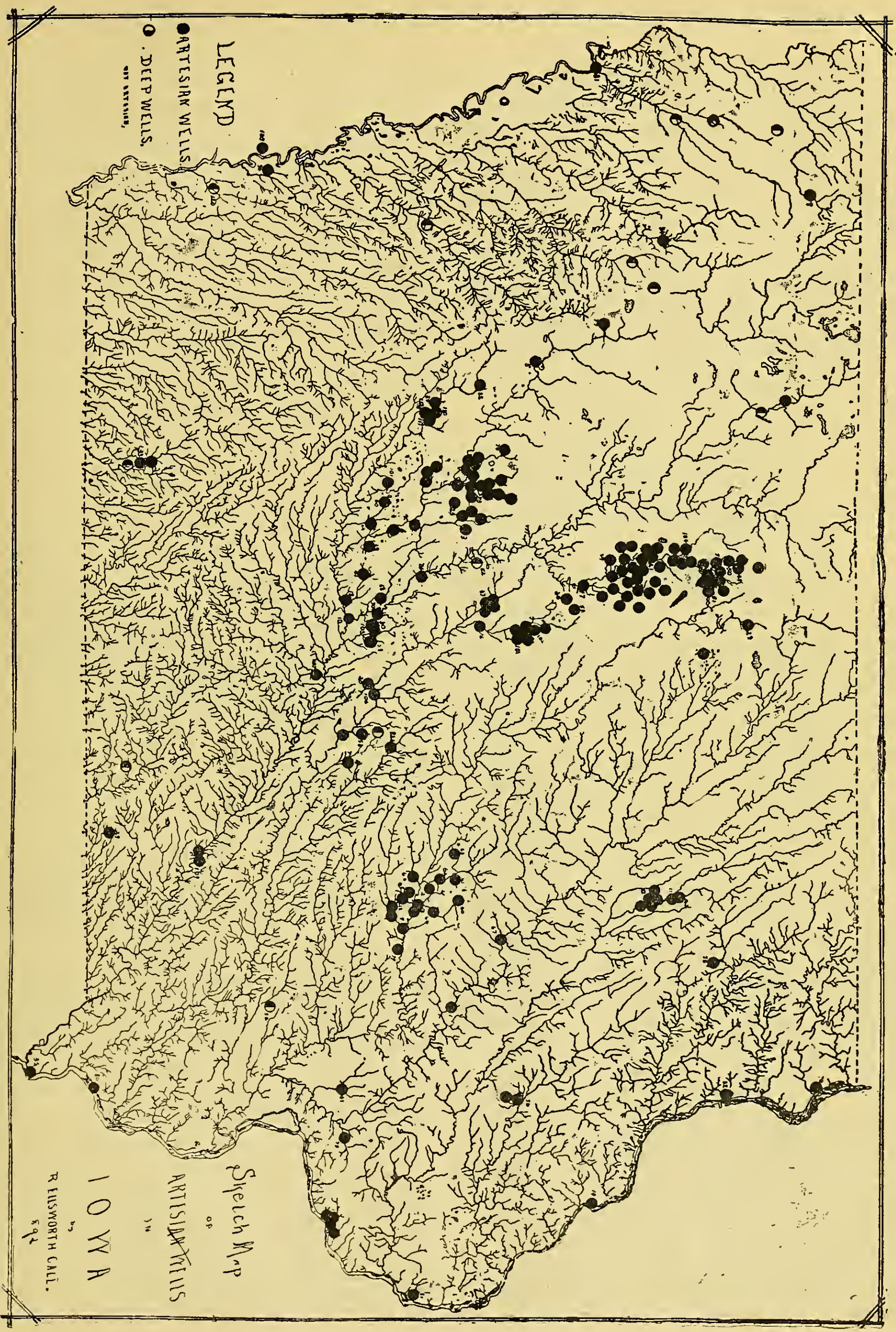
No.		Feet.
1.	Dark-gray limestone	50
2.	Light-gray limestone	85
3.	Gray limestone	40
[1] 4.	Coarse-grained, reddish-brown limestone	65
[1] 5.	Coarse, brown, and very porous limestone	60
6.	Coarse, light-brown limestone, mixed with shale	30
7.	Shale	20
8.	Coarse, dark-gray limestone	25
9.	Coarse, light-gray limestone	45
10.	Tough, blue clay	200
11.	Reddish-brown sandstone	205
12.	Shale	5
13.	Dark, bluish-gray sandstone	65
14.	Shale	1
15.	St. Peter's sandstone	50
16.	Gray sandstone	74
[1] 17.	Brownish sandstone	40
[1] 18.	Coarse-grained, porous, brown sandstone	270
19.	Light sandstone	88
20.	Dark-colored and hard sandstone	42
21.	Brown, very close-grained and hard sandstone	140
22.	Blue clay	100
23.	Soft, reddish-brown sandstone	160
24.	Potsdam sandstone	200
25.	Red sandstone	75

[1] Contains water.

Over the eastern third or more of Iowa, east and north of the line drawn from Keokuk to the vicinity of Sioux City, as above mentioned, thence north-easterly to Worth or Mitchell Counties, the St. Peter's Sandstone may be reached in deep wells, and flowing water found. North of that part of the line which extends north-easterly from Sioux City flowing water will not be found, if the indications of the strata penetrated in the Hull, Sioux County, wells are reliable. From that place igneous rocks, presenting a volcanic facies, have been submitted to us.

The south-western part of the State, that is, all that part of Iowa which lies south of the first arbitrary line above indicated, will not furnish artesian waters. The section, which is given elsewhere, of the Glenwood deep-boring furnishes the most complete vertical section of the carboniferous rocks, which is exhibited in Iowa. It further affords no hope that artesian waters will be reached at reasonably profitable depths in that portion of the State.

Readers of *Science* who may be interested in the details of an investigation, of which this notice is a brief abstract, may receive the full paper on addressing the Iowa Weather and Crop Bureau, DesMoines, Iowa, under whose auspices the work has been done. E. ELLSWORTH CALL.


LEGEND
ARTESIAN WELLS.
DEEP WELLS.
Sketch Map
of
ARTISIAN WELLS
in
IOWA
by
R. ELLSWORTH CALL.
'92

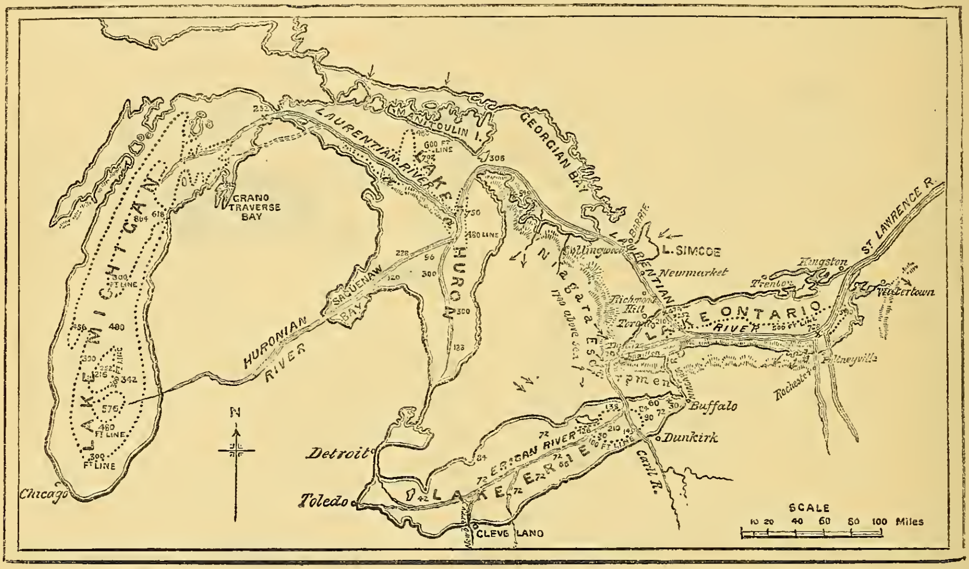
REVIEW OF THE ORIGIN OF THE BASINS OF THE GREAT LAKES.[1]

THE origin of such prominent features as the Great Lakes has a general interest to others as well as to geologists; but even phenomena so commonplace are not always readily explained. The delay in this case has been largely due to the want of information that could only be obtained by numerous borings, accurate levelling, and other data obtainable in regions where few active workers in surface geology have been carrying on their investigations. To these causes may be added a *quasi* satisfaction with favorite theories, to which facts are often moulded.

A score of years ago the mysterious agent which formed the lake basins assumed the guise of glaciers digging out new troughs or fashioning older ones. This plausible hypothesis received consideration, as it was championed by Dr. J. S. Newberry and other eminent men. At that time, and for years after, the extraordinary erosive power of glaciers, in scooping out basins, was an article of faith; but to-day few observers of existing glaciers, or of real extinct ones, have not modified this old creed, as observations do not support it. Apart from the question of the ability of ice to plough out great basins, the direction of the ice scratches about the Great Lakes is oblique, or often at right angles, to the escarpments or rock walls which bound the lakes, or are submerged in them. These phenomena were first emphasized in America by Dr. J. W. Spencer, and were sufficient to disprove the hypothesis, even if no other had been available.

The amount of glacial erosion demanded was more than could be accepted by many glacialists. Accordingly Dr. T. C. Chamberlin accounted in part for the lake basins as due to depressions produced by glaciers accumulating to a greater thickness over preglacial valleys, but that with the retreat of the glacier the waters left in the basins still depressed the earth's crust. The demonstration of such a theory could scarcely be hoped for. It not only begged the question, but in doing so it did not consider that the previous removal of the hundreds of feet of rock, in forming the accepted valleys, ought to have permanently produced the opposite effects upon the earth's crust to that of the small quantity of water left in the basins, especially as the basins were sometimes shallow and sometimes channel-like.

These theoretical explanations showed the necessity for further research, which has been made by Dr. Spencer with results announced from time to time for more than a decade, and may be summarized as follows: The lake basins are simply valleys of erosion, formed during periods of high continental elevation lasting long enough for the excavation of broad, deep valleys. This elevation amounted to 3,000 feet above the present altitude, as shown by the submerged channels upon the coast; and temporarily the continent appears to have reached even 6,000 feet. Some of the lakes now descend to nearly 500 feet below sea-level. The basins of the lakes were just such broad valleys as that of the modern St. Lawrence River north of the Adirondacks or farther seaward. During the later geological times, and reaching down to the modern days, the physical revolutions of the Ice Age converted the old valleys of the St. Lawrence (Laurentian) River and its tributaries into basins, in which the modern lake waters are held. The phases of the physical revolutions which fashioned the basins were partial obstruction of the old waterways by drift accumulations, a general



[1] "High Continental Elevations Preceding the Pleistocene Period (in America)," with map. Read before Geol. Soc. Am., Aug., 1889. Bull. of Soc., vol. i. Geological Magazine (London), dec. iii., vol. vii., 1890.

"Origin of the Basins of the Great Lakes," with map of the Ancient St. Lawrence River and Tributaries. Quar. Jour. Geol. Soc. (London), vol. xlvi., 1890. Reprinted in American Geologist, vol. iv., 1891.

"Deformation of the Iroquois Beach and Birth of Lake Ontario," with map and illustrations. Am. Jour. Sci., vol. xl., 1890.

"Deformation of the Algonquin Beach and Birth of Lake Huron," with map and illustrations. Am. Jour. Sci., vol. xli., 1891.

"High-Level Shores in the Region of the Great Lakes, and their Deformation," with map. Am. Jour. Sci., vol. xli., 1891.

"Post-Pliocene Continental Subsidence," with map of deserted Short-Lines in the region of the Great Lakes. Read before Geol. Soc. Am., Dec., 1890. Bull. of Soc., vol. ii.

subsidence of the region, and a re-elevation of the land, rising most rapidly towards the north-east, whereby rock barriers, in fact, were formed across the old valleys.

The drainage by the ancient Laurentian River from Lake Michigan is shown by the remains of channels 600 feet deep, in the otherwise shallower north-eastern end of the lake. It crossed the Huron Basin at the foot of a high but now submerged escarpment. It passed into Georgian Bay by a submerged channel between the islands, also now partly buried by drift. The waterway through the shallow Georgian Bay is still left open to a depth of nearly 600 feet below the surface of the water along the edge of the Indian Peninsula. Thence to a point about twenty miles east of Toronto, where the deep river channel is seen near the shore in the shallower portions of Lake Ontario; this ancient valley is deeply buried by drift accumulations. The chain of borings reveal it to a depth of hundreds of feet beneath the rocky floor of the country through which it passes. Through Lake Ontario it is seen at the foot of a submerged escarpment, extending eastward to the point where the recent warpings, recorded in the shore lines, bring up the old channel to near the surface. This warping, recorded in the beaches north of the Adirondacks, is sufficient to account for the rocky barrier between Lake Ontario and the sea, the rise being five or six feet per mile towards the north-east. The warping east of Georgian Bay is 4 feet per mile; at the outlet of Lake Huron, 2 feet; at the eastern end of Lake Erie, 2 feet; and at the head of the lake it diminishes to zero. Across the Peninsula of Michigan an ancient tributary (Huronian River) flowed through a valley now buried by 500 feet of drift, or 350 feet beneath the lake, and through Saginaw Bay to join the Laurentian River. Through Lake Erie, and buried beneath the mud upon its floor, the ancient Erigan River drained the valley, and passed through the buried channel at the head of Lake Ontario. Such was the ancient drainage of the youthful lake basins, which date back only as far as the later Pleistocene period, since changed, owing to drift accumulations obstructing the valleys and to warpings of the earth's crust.

No phenomena of the Pleistocene period rests upon more substantial evidence, which very slowly appeared. The history of every great natural problem presents the same story. The literature of the older writers was not useless, but awakened an interest and gave suggestion, as the data had not been collected. Such, however, is the record of progress that much of every observer's work is only a means, which must be modified before reaching the end.

NOTES AND NEWS.

THE Italian Geographical Society has been authorized by the Municipality of Genoa to convoke a geographical congress to be held in that city, in commemoration of the fourth centenary of the discovery of America. No historical event is more deserving of celebration by geographers throughout the world. It was this idea that inspired the International Geographical Congress, held at Bern in 1891, when it decreed that to the commemoration in Genoa and in Spain, all geographical societies should be invited to send delegates. The congress will take place about the middle of next September. The precise date of its inauguration will be made known as early as possible.

— The Jury of Awards of the International Exposition at Paris, 1889, has awarded the Grand Prize to the United States Department of Agriculture for "Organization Methods and Material for Agricultural Instruction." In the award, Professors Atwater and Taylor are particularly distinguished, Professor Atwater, for his exhibit of maps and photographs on agricultural colleges, and Dr. Taylor, microscopist, for his collection of photographs and drawings of the microscopic analysis of food adulterations, especially butter. Each of these gentlemen is awarded a silver medal.

— Australians have had bitter experience of the mischief which rabbits are capable of doing, and now they seem likely to have trouble of a similar kind from the introduction of foxes. An Australian journal, quoted in the May number of the *Zoologist*, says that foxes have already spread over a wide area, and are most destructive both to lambs and poultry. They attain greater size and strength in Australia than in England, and the mild climate is highly favorable to the increase of their numbers. "It must be very disheartening," says the writer, "to all who have stock of any kind to lose, to find themselves confronted by some new enemy introduced by thoughtless or selfish persons. If some energetic steps are not soon taken, nothing can prevent the spread of foxes over the whole continent."

— The Civil Service Commission will hold examinations on the 28th of June, continuing through the 29th, to fill two vacancies in the position of computer in the Coast and Geodetic Survey at $1,000 a year, and one in the position of draftsman at $900. Arrangements may be made to hold the examinations in some of the large cities outside of Washington if there should be applicants. The subjects of the computer's examination will be orthography, penmanship, letter-writing, algebra, trigonometry, geometry, geodesy, practical astronomy, and differential and integral calculus. The subjects of the drafting examination will be letter-writing, geography, arithmetic, algebra, geometry, descriptive geometry, plane and spherical trigonometry, shades and shadows, and drawing. Application blanks may be had of the Civil Service Commission. Residents of the District of Columbia are ineligible. Applicants will be required to furnish the necessary implements for drawing.

— The new professor in physiological psychology at Yale is announced to be E. C. Scripture of Clark University. He has been chosen by the faculty, but his choice will not be confirmed until the meeting of the corporation. Mr. Scripture is one of the most brilliant disciples of the noted German philosopher, Professor Wundt. He is at present a valued assistant of President Hall of Clark University. Professor Scripture will enter upon his duties at Yale at the opening of the next college year. His selection involves the opening of an entirely new department at Yale, that of scientific physiological investigation in mental philosophy and psychology. This line of work is entirely new in American universities, the department at Yale being the third or fourth to be put into practical operation in this country. A new psychological laboratory will be built for the use of Professor Scripture and his assistants. It will contain all the latest appliances for scientific work. Work upon it will be commenced at once, and it will be ready for occupancy by the first of October.

— At the eighth annual meeting of the Kansas University Science Club held in Snow Hall, on Friday, May 27, 1892, the following papers representing original research were presented: Notes on Magnetic Declination, F. O. Marvin; Constants for the Fauth Alt-azimuth, No. 296, A. O. Ridgeway; Examination of Stramonium Seed, L. E. Sayre; On the influence of Parapeptones on Digestion, L. E. Sayre and H. Day; The Coffee Bean, L. E. Sayre and F. C. Combs; On Parachlormetanitrotoluene, E. C. Franklin; Analysis of a Mineral Water from Nemaha County, Kansas, E. H. S. Bailey and J. F. Noble; Analysis of the Alcaloid of Solanum rostratum, C. E. McClung; On the Affinities of the Phryganidæ and the Lepidoptera, V. L. Kellogg; On the Taxonomic Value of the Scales in Lepidoptera, V. L. Kellogg; A Graphic Method for Angle Blocks in the Howe Truss, A. S. Riffle, Portland, Oregon; Viaduct on the T. A. A. and N. M. R. R. at Ann Arbor, Mich., H. E. Riggs, Chief Engineer; A New Method for Extinguishing Fires in Dwellings, L. I. Blake; On MacCullagh's and Salmon's Methods of Generating Quadratic Surfaces, H. B. Newson; Maximum Moment in an Arch-rib, E. C. Murphy; Kansas Pterodactyls, Part I, S. W. Williston and E. C. Case; Kansas Mosasaurs, Part II, S. W. Williston; The Analysis of some Kansas Building Stones, E. C. Case; The Diseases of Grasses, W. C. Stevens; A Method of Trisecting an Angle, A. L. Candy; Brazilian Diptera, Part II, S. W. Williston.

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AUGUST WILHELM VON HOFMANN.

ON May 6, 1892, the New York papers announced the death of this great chemist, in a brief despatch from Berlin; and the comments upon his life and works took an equally brief form. Yet there was probably no German professor whose name was dear to so many American pupils, no foreigner who viewed American science so sympathetically, no contemporary who had left so deep an impress upon one of the cardinal branches of human knowledge and industry. Chemical journals will bring to every laboratory eloquent tributes to the memory of the deceased master; but I am glad that this paper, which appeals to the general scientific public of the United States, opens its columns to a testimonial, however trifling and inadequate, from one of the departed master's pupils.

August Wilhelm Hofmann was born April 8, 1818, in the Hessian town of Giessen, in which his father lived as an architect. Giessen was an obscure town, harboring the equally insignificant University of the Grand Duchy of Hesse-Darmstadt. But six years after the birth of Hofmann an event occurred which was to have a curiously analogous effect upon his own career and that of his native town, the installation of Justus Liebig in the chair of chemistry. From a torpid mediæval village, Giessen became a centre of intellectual activity; its university achieved imperishable renown as the first to establish a laboratory devoted primarily to *instruction*. Equally beneficent was Liebig's influence upon young Hofmann: after devoting his attention successively to philology and to law, the example of Liebig drew him irresistibly toward chemistry, and he became one of his most enthusiastic and successful pupils. His first connection with Liebig was of a personal nature, since the erection of the University Laboratory, which was entrusted to the elder Hofmann, brought the two families into intimate relations. Later he married a niece of Liebig's wife.

His first apprenticeship as teacher, after the formal completion of his studies, was likewise passed under Liebig's eye; but in 1845 he established himself as *privat docent* in Bonn, although he was not destined to remain there long. Late in the same year he accepted an invitation to become the head of the Royal College of Chemistry, then newly established in London by Prince Albert, the Consort of the Queen. This institution was avowedly intended to be a reproduction, on British soil, of the Giessen Laboratory, and the choice of its director could not have been a happier one. The English pupils found in their teacher not the traditional German pedagogue, narrow, pedantic and awkward, visionary and incapable of adapting himself to his surroundings; but a brilliant lecturer, an energetic executive officer, a polite gentleman, a kind and encouraging teacher, and a sympathetic friend. During the seventeen years of his life in London he seemed to have completely assimilated himself to his surroundings, and the English world of science, ordinarily so nativistic, seems to have admitted him unreservedly within its fold. In fact, there was nothing upon which his energy and sagacity might be brought to bear, with which he was not entrusted. If there was a question to be solved in the manufactures, if the Treasury wanted advice in excise matters, if a competent judge were needed in international exhibitions of science and arts, if learned societies were in search of a representative head, recourse was always had to Hofmann. In fact, he received what was for many years the highest scientific reward in the bestowal of the Crown, the Mastership of the Mint. In England his greatest and most lasting work was doubtless accomplished. It was there that he and his pupils first investigated the organic compounds of phosphorus, the complicated ammonia bases, the cyanides, the isonitrils, and the mustard oils. In his laboratory the aniline dyes and the azo-dyes were discovered by himself and his pupils Perkin and Peter Griess. From all parts of the world pupils came to work under him, and I have heard him relate with pardonable pride how he was always sure in his extensive travels to find old pupils, be it in the extreme west and south of the United States or on the outskirts of European civilization in Egypt and Asia Minor. The Royal College of Chemistry became a place of pilgrimage for the young chemist, similar to Liebig's laboratory in Giessen, or to Berzelius's house in Stockholm, or Gay-Lussac's in Paris, in earlier times.

Nevertheless, he acceptod a call in 1862 to found a University Laboratory at Bonn, and actually planned and superintended the erection of the building. Before he could enter upon his duties as director, however, he received an invitation to a still larger field. He was to become the successor in Berlin of two recently deceased chemists of great renown, Mitscherlich and Heinrich Rose. A new University Laboratory was to be built in what was rapidly becoming the metropolis of Germany; the Royal Academy was anxious to provide additional facilities for private research. So it happened that Hofman really went straight from London to Berlin, in 1865; Kekulé filled the vacancy in Bonn, while Williamson assumed charge of the Royal College of Chemistry.

Until his death, Hofmann remained at the head of chemical affairs in Berlin. The laboratory was built in 1867, and at once was completely filled with students; in a short while it became rather uncomfortably crowded, and has remained so until now. It has always harbored numerous foreigners, especially Americans. As member of the Prussian Academy, he was entitled to a research laboratory and a dwelling, which were so connected with the Students' Laboratory that no time was lost in passing from one to the other; even at times when he was not passing through the laboratory, a student requiring an answer to a serious question was always at liberty to seek him in his private laboratory or his library. He restricted his personal instruction, however, to a fourth of the students who were at work in the laboratory building, turning over the rest completely to his assistants. He lectured three to five times a week for two consecutive hours, always on elementary subjects. In winter the course was upon general inorganic chemistry; in summer upon organic chemistry. These lectures were profusely illustrated, very entertaining, and remarkably lucid. But their purpose was evidently much more to interest the beginner and to show him the beauties of the treasures within reach, than to present an actual key to these treasures, or, in other words, to deeply impress facts upon his mind. For eloquence and noble enthusiasm no speaker could surpass him.

As a teacher in the laboratory he was painstaking to the last degree. Restricting himself to a favored few and practically limiting the range of their instruction to organic synthesis, he endeavored to visit each at his desk once or twice a day, and would give him all the time he needed. Each new comer was put, for a longer or shorter period, at the preparation of well-known compounds, merely for the sake of practice. It was delightful to see the interest which he took in this routine work, the manner in which he made each tyro feel as if something depended upon the careful completion of these tasks. He would hail each carefully prepared specimen as if it were the most novel thing in the world to himself, and if it happened to be a substance upon which he had worked in former years, he would take especial pleasure in exhibiting all its properties. After a certain time, the student would be put upon an "original" investigation. As a general thing, it must be confessed, the results of these investigations did not show too much originality. He generally assigned subjects closely allied to work that was being done or had been done in his own private laboratory, the work of his students generally presenting corroborative evidence to results already obtained. But he always encouraged original thought, and was very ready to give credit for it. Whether the student was dull or bright, whether his investigation proved interesting or not, Hofmann was always helpful and encouraging; the only thing he could not stand was laziness. As a matter of fact, in spite of the freedom from disciplinary control in German universities, few American college laboratories could show so constant an attendance at all hours. He always took the greatest interest in the personal welfare of his students, and, especially if they were foreigners, would treat them as if they were instrusted to his personal care.

In his own work, he was indefatigable, and his private assistants, of whom there were four or more, certainly had arduous duties to perform; he would frequently work with them from 8 A.M. until 11 P.M. When he was a younger man, there were times when work was continued in relays, without any intermission, until it was completed. But there was never a lack of volunteers to fill any vacancy on his staff of assistants, even though the pay was very moderate. In return, he was kindness itself in looking out for their future and in providing for their relaxation in vacation time, so that they were always his enthusiastic followers.

As to his scientific achievements, the present writer is not sufficiently presumptuous to even hint a personal opinion; he believes, however, that it is the general judgment among those best qualified to speak, that Hofmann's great success was due to his great energy, his marvelous dexterity of manipulation and observation, and careful deductive reasoning, rather than to any startling brilliancy of invention, such as that of his master, Liebig. Hofmann's contributions both to pure and to industrial chemistry are those of the investigator, not of the inventor. He neither invented the "type" theory of Laurent and Gerhardt; nor did he first discover the production of coloring matter from aniline; in the various discussions of the fundamental structural formulæ, he rarely took part. But, the type theory once given, it was he who did the most to elucidate the "ammonia-type;" when rosaniline had been produced, it was his privilege to clearly explain the reasons that had brought about this happy accident and to show how the whole gamut of colors could be produced in a similar manner. The complicated ureides, the innumerable benzol derivatives, the natural and artificial alkaloids were all manipulated by him in a manner to make them more accessible to further study and more useful to mankind. Generalizations and metaphysical speculations were entirely foreign to his nature.

A peculiarly apt illustration of this bent of his mind may be found in the manifold apparatus he invented for the purposes of demonstration or investigation. While it never involved the application of new principles, as did those of Lavoisier, Gay-Lussac, Davy, Faraday, or Victor Mayer, it always showed the most thorough knowledge and most ingenious applications of all established methods of physics and of chemistry. For elegance and for the unfailing certainty of success in working, the apparatus invented by him will always stand pre-eminent.

To illustrate his energy and power of self-sacrifice, I would instance the occurrences after a serious illness which befell him at the age of 68, in the spring of 1886. He had been confined to his room for several weeks, and was not allowed to see anyone; barely recovered, he sent for his assistants, to hear their reports and sketch out new work; before he was allowed to leave his own house he sent for his students, day by day, to talk over their progress. As soon as the physician grudgingly assented, he resumed his lectures, not only speaking for two hours a day, at the regular hours, but actually striving to make up for lost time by giving an additional lecture three times a week from 6 to 8 A. M.! Such a tax upon the strength of an old man, weakened by sickness, seems tremendous. But he seemed not to mind it in the least.

As a traveller, too, he was untiring: fatigue which completely overcame younger men, did not seem to exist for him; as a matter of fact, the extreme Orient and Australia were the only civilized regions which he did not visit, and these he would surely have sought to reach, if his conscientiousness had not prevented his seeking a sufficiently protracted leave of absence.

He always spoke with special pleasure of his visit to the United States in 1883, and seemed greatly to appreciate the cordiality of his reception here. Probably he had a better understanding of the limitation imposed upon scientific research in America than do most foreigners; for he has always praised what has been done, without churlishly demanding the perfection reached at older and more firmly established centres of knowledge.

In his private life, he was greatly beloved by all who knew him, and he certainly was able to make and maintain the warmest friendships. In his later years, he devoted much of his time and ability to the bitter-sweet task of sealing this intimacy with an eloquent testimonial to the worth and renown of the "Friends who had gone before." For such memorial biographies the world owes him additional gratitude; for the lives of Liebig, Wöhler, Dumas, and Graham, as described by him, will surely arouse the latent enthusiasm in many a youthful mind, and thus serve to pass on the torch of learning to new bearers.

His personal magnetism had much to do with the unprecedented success of the German Chemical Society, which was founded by him in 1868, and which is now in point of membership and influence the most important scientific body of the world. A society embracing men of every nation could only have been founded by a man who had no petty narrowness himself, who could impartially recognize and assimilate what was good wherever he found it. As a cosmopolitan, Hofmann could bring to London the thoroughness of the German schools of learning and imbue his surroundings with it, bringing back in return to Berlin the breadth of political views, the openness of social intercourse, the tolerance for opposing views, which existed in the English capital. While Hofmann shunned every form of altercation and was rarely drawn into political or social discussions, it was well known that his views were always democratic and for toleration of every sort. The only time he ever incurred the enmity of a class was during his rectorate at the Berlin University, when he took stern measures to prevent the introduction of political and religious intolerance in the student circles. I do not doubt that he was a patriotic German in every respect, but no other German has ever written words so appreciative of the French character, as it showed itself during the terrible siege of Paris, so hearty in deprecation of the fact that political jealousies have strained scientific relations—as are to be found in Hofmann's eulogies on Dumas and Wurtz.

In Hofmann the world has lost the model of a scientific man: a lover of science, both for its own beauties and for the benefits it confers upon mankind, a devoted teacher, a shining example of the rewards to be obtained by industry, integrity, and singleness of purpose. Those who have enjoyed the privilege of his personal contact will always be grateful for the view he opened to them of the beautiful and the true. MORRIS LOEB.

University of the City of New York.

CURRENT NOTES ON ANTHROPOLOGY. — VII.

[*Edited by D. G. Brinton, M.D., LL.D.*]

Laws of Variation and Fixity in Species.

IT is well observed by Dr. C. Dareste, in a recent lecture, that the fundamental question in anthropology is the origin of the differences in the human species. These differences begin with those visible in every individual, and extend up to those broad and permanent traits which distinguish the subspecies of man from each other. Beyond this they nowhere go; that is to say, no "missing link" exists which connects in an uninterrupted chain the human with any other vertebrate.

In explanation of this phenomenon of indefinite variation within fixed limits, M. Ch. du Pasquier has published an ingenious theory in the *Bulletin de la Société d'Anthropologie de Paris* (1891). He suggests that the fixity of the species, instead of being an argument against the theory of evolution, is the natural corollary of its two great factors, 1. The law of constant variation, and 2. The law of fixed heredity. These act with like mechanical inflexibility as the motions of a pendulum, always moving but unfailingly self-limiting, and thus determining the invariability of the specific type, while leaving a wide range for racial and individual variability. His argument is lengthy and ingenious, and well worth close reading.

In such a study, where especially the characteristics of races are the chief topics of investigation, the anthropologist will act wisely if he follows closely the track of the general zoologist. With a few easily explained exceptions, the areas of characterization of the species man are identical with those of the higher living vertebrates; and it is very significant that zoologists acknowledge that no two of these regions are of equal rank in their capacity for the development of organic forms. This has direct bearing on the deep-seated differences between races, and explains how they can be radically diverse and yet members of the same species.

The Criminal Anthropology of Woman.

It is a fact that in all countries there are fewer convictions for crimes of women than of men. European statistics vary from the highest, 37 per cent, in Scotland, to the lowest, rather less than 6 per cent, in Italy. It is also noted that there is a very wide difference between city and country. The proportion of female criminals is always higher in rural districts, sometimes reaching nearly to that of the males.

Various explanations of these facts have been suggested. Some are complimentary to the sex, as that women are not given to intoxicants, nor to gambling, nor to roving; they are more timid, more religious, more tender-hearted, and their sexuality is more passive. There is something in all these reasons, but they do not satisfy Dr. G. Ferrero, who discusses the subject in the *Revue Scientifique*, March 26. He points out that the females of the ants, bees, and spiders are particularly cruel because they are particularly intelligent, and he reaches the ungallant conclusion that the woman of to-day is less criminal because less intelligent than the man. This difference is less in country districts than in cities; and, moreover, in cities a woman can obtain a living at less risk than by criminal acts, *par complaisance vers l'homme*. Her struggle for life is less desperate; she is less an egotist because she is protected more than men; she is less disturbed by new ideas because she is slow to perceive them. When she is bad, however, she is "very, very bad," surpassing men in callous cruelty and absence of pity or remorse. In support of these assertions he cites instances both from history and the courts of criminal procedure.

Buddhism in the Occident.

The position of the anthropologist in the study of religions should be altogether a judicial one, and not that of a disciple. One cannot regard it other than a mistake, therefore, that in Paris there has grown out of the scientific study of Buddhism a school of "Eclectic Buddhism," whose disciples are pledged to obey the principles of the school, to carry out the moral obligations it imposes, and are liable to expulsion if they transgress the "rule of conduct."

The "Master" is apparently Professor Leon de Rosny, whose lectures on Buddhism at the Sorbonne have excited much attention, and who is widely and favorably known in American as well as general ethnology. Last year he issued a brochure entitled "La Morale du Bouddhisme," which is probably the text-book of the school.

No one will doubt the solid ethical ground-work which underlies all the "world-religions," Buddhism, Islam, and Christianity. It is in their religious philosophy that their sharp contrast is seen; and nothing could be more remote from the highest thought of modern Europe than the philosophy of Buddhism. This is well shown by what Barthelemy Saint Hilaire says of it in his "Life of Eugéne Burnouf," published last year (p. 43), "At bottom, Buddhism is nothing more than the fanaticism of nothingness. It is the destruction of the individual carried remorselessly out to his last legitimate hopes."

The science of religion is as yet altogether too novel a branch of study to become creative or directive. It has before it a long period of analysis before it should presume to be synthetic. So this Parisian effort must be considered premature

Physical and Mental Correlation.

That veteran anthropologist, Professor Schaaffhausen of Bonn, observes in his "Anthropologische Studien" (p. 646), "One of the weightiest doctrines of anthropology is that of the constant correspondence between the development of the physical organization and the intellectual capacity."

So far as the relation between brain-structure and mental ability is concerned, probably no one who has himself studied the facts will deny this. But, in another direction, scientists are less in unison, and that is, where the question of personal beauty is concerned. Even so competent a physical anthropologist as Topinard repeats in his last work the assertion that there is no fixed canon or norm of human beauty; that it is merely a local and factitious notion, and is devoid of weight as a general factor of evolution.

This narrow opinion has, it is true, the sanction of Darwin, Humboldt, and the whole school of association philosophers; but how erroneous it is will readily be seen by reflecting on the application of the law of correspondence above quoted. Leaving aside obviously aberrant and morbid forms, such as mutilations and artificial deformities, it will be found that the underlying motive of the beautiful is that of highest function,— which is inseparable from highest capacity. The conditions required for such result are health, physical development, corporeal symmetry, and the culture of that which is peculiarly human as distinguished from what is merely animal.

When nations have ideals of beauty contrary to these principles, it is an indication of low culture and capacity. As they advance in these their ideals steadily near a definite and the same conception of the perfect human form; though it is not to be expected that the species will ever unite on any one fixed canon, because it is in the very nature and essence of the ideal that it can never become cabined, cribbed, confined within the material fetters of the real. One of the few anthropologists who have recognized and pointed out this gradual evolution of the ideal of beauty in the history of the species is Professor Gerland of Strasburg, in his treatise on general ethnography.

Relics of Glacial Man.

It has been shown by Chamberlain and Salisbury (*American Journal of Science*, May, 1891) that the Loess of the Mississippi valley basin overlies the glacial drift and so-called Orange Sand south of the limit of glaciation, and where it occurs north of this limit its relations are to the first glacial deposits. This identification lends especial importance to the finding of flint chips and arrow-heads in the Loess at Muscatine, Iowa, as related by F. M. Witter in the *American Geologist*, April, 1892. The evidence is not so direct or clear as one would like, but it should be enough to stimulate a thorough search in the locality.

A find of equal interest is reported from France. M. S. Meunier relates in *Le Naturaliste*, March 15, that near Montereau, in the Department of Seine et Marne, below five meters of quaternary gravels, a workman exhumed a piece of sawed horn of the extinct *Megaceros hibernicus*, and immediately adjacent to it a vase of very rude pottery, about three inches in diameter. The Megaceros belonged to the period of glacial cold, called by De Mortillet the Mousterien, and the association of pottery with the art of man in that early time is novel, but not at all incredible.

ASTRONOMICAL NOTES.

[*Edited by George A. Hill.*]

Winnecke's Comet.

WINNECKE'S periodic comet is now an easy object in a three-inch telescope, and, as it is very favorably placed for observations, it is hoped that those who have the instrumental equipment will include this object in their work. We continue the ephemeris of the comet by Dr. Haerdtl: —

	R.A			Dec.	
	h.	m.	s.	°	′
May 31	10	53	13	+ 43	25
June 1		51	50	43	19
2		50	23	43	12
3		48	52	43	5
4		47	16	42	57
5		45	35	42	49
6		43	46	42	41
7		41	51	42	33
8		39	47	42	24
9		37	34	42	14
10		35	12	42	5
11		32	38	41	54
12		29	52	41	43
13		26	52	41	32
14	10	23	37	+ 41	19

Swift's Comet

The following is an ephemeris of Swift's comet. It is based upon a parabolic orbit computed by Dr. Berberich of Berlin. The epoch is for Berlin midnight: —

	R.A.			Dec.	
	h.	m.	s.	°	′
May 31	23	52	24	+ 37	16
June 1		54	36	37	30
2		56	46	38	3
3	23	58	54	38	26
4	0	1	1	38	48
5	0	3	6	39	10
6	0	5	10	39	32
7		7	12	39	53
8		9	11	40	14
9		11	9	40	34
10		13	5	40	54
11		14	59	41	14
12		16	51	41	34
13		18	41	41	52
14		20	30	+ 42	11

NOTES ON LOCAL BYTHOSCOPIDÆ AND CERCOPIDÆ.

In the Bythoscopidæ, *Podiopsis viridis* Fitch is a rare insect with me, of which I have never taken more than a dozen specimens. Professor J. B. Smith mentions Fitch's *P. trimaculatus* as occurring in New Jersey, but as yet I have never been able to discover it, although it may be securely hidden among a lot of undetermined material so common to many entomological collections, and so detrimental to the science in not being recorded. As no list of the Hemiptera of this locality has ever been published, I have used Professor Smith's as a basis on which to establish the possible occurrence of many species, although the only species I am responsible for are those I have collected, many of which have been determined by Professor Van Duzee.

In *Bythoscopus* I have taken *pallidus* Fitch, now known as *Idiocerus pallidus* Fitch; this is not a common species, but is represented in my collection by a dozen specimens. *Bythoscopus seminudus* Say I have not taken, but it is no doubt a resident species, and is given from New Jersey.

Agallia is represented by two species, *A. sanguinolenta* Prov. and *A. quadripunctata* Prov., the latter species being quite common, and the former rare.

Idiocerus alternata Fitch, *I. lachrymalis* Fitch, *I. maculipennis* Fitch, and *I. suturalis* Fitch are all recorded from New Jersey, and are Fitch's types. So they should occur with us also, but I have never taken any of them as far as I know.

In the *Cercopidæ* we have quite a number of species, strong in character and abundant in numbers.

In the sub family *Cercopinæ* I have never taken a single representative species; but Professor Smith records *Monecphora bicincta* Say as occurring in New Jersey, and it no doubt occurs here also.

In the sub-family APHROPHORINÆ, *Lepyronia quadrangularis* Say is very common on grasses and weeds (so-called). *Aphrophora parallela* Say and *A. quadrinotata* Say are rare, the first being the most common of the two species. Fitch's *Aphrophora sarogotensis*, now known as *Philaenus sarogotensis* Fitch, I have never found, although it should be with us.

Philænus bilineatus Say, *P. lineatus* Linn., and *P. Spumaria* Germ. are recorded from New Jersey, and will no doubt be found to occur here also.

Clostoptera is represented in my collectiou by two species, *C. proteus* Fitch and *C. obtusa* Say, the former species being the most common. Professor Smith gives *C. achatina* Germ., *C. pini* Fitch, C. *testacea* Fitch, and *C. xanthocephala* Germ. as occurring in New Jersey.

In the sub-family LEDRINÆ I have not as yet found a single representative species, although *Ledra perdita* is recorded from New Jersey, and should occur here also.

In the sub-family GYPONINÆ three species are represented: *Gypona* 8 *lineata* Say being the largest and most beautiful of the series. This insect varies in color from a delicate yellowish green to those who have the entire veining of the wings a brilliant scarlet, which suffuses the entire head and thorax also. These were taken from young, vigorous sprouts of *Platanus occidentalis* Linn. and also from the trunks of *Ulmus americana* Linn.; the latter were taken during a severe and protracted rain-storm, when they were apparently driven from the foliage, and sought shelter in the crevices of the rough bark. My experience has shown that such a time is very advantageous for collecting rare and new species of Hemiptera, as very many species taken then have never been found by me in any other situation, and many can in this way be taken, which the sweep-net will fail to reach.

Gypona flavilineata Fitch is slightly greener in color and without the scarlet veining in the fore-wings. In size it is a trifle smaller. Many of these were taken from the trunks of elms with *S. lineata*, and also at electric lights.

There is great difficulty (in collecting Hemiptera) in knowing just where a certain species comes from. If one sweeps the grass, a myriad of weeds and plants are covered, and it is impossible to tell from which food-plant the species may come, or, if it is maintained by different plants, which one it is the most partial to.

The third species of *Gypona* is new, or at least is not known to Professor Van Duzee; this is much greener than the last, with a suggestion of brown on the inner edges of the fore-wings.

Xerophloea viridis Fobr., recorded from New Jersey, I have never taken here, nor have I seen *Paropholis peltata* Uhler, nor the two species of *Penthimia P. atra* Fabr., nor *P. americana* Fitch.

In the sub-family TETTIGONINÆ we are quite well represented. What we have before known as *Proconia undata* Fobr. is now referred to *Oncometopia* and known as *O. undata* Fobr. Professor Smith records *Proconia costalis* Fabr. as occurring in New Jersey, and also *Oncometopia obtusa* Fobr. and *O. orbona* Fobr. These also will no doubt prove to be resident species with us also.

Homalodisca coagulata Say, recorded from New Jersey, I have never taken. *Aulacizes irrorata* Fobr. is represented by two species, but they are without data, and I do not know if they were even taken in the State. I do not remember ever having taken this species.

Diedrocephala coccinea Forst. is very common with us, but shows such diversified markings that there appear to be two species, while still allowing ample color distribution. They occur from a pale green to a brilliant red, the red ones showing a fine green line on their fore-wings, and the green ones a fine red line. *Diedrocephala mollipes* Say is also common; it is more uniform in coloration. *D. noveboracensis* Fitch is of a brilliant green, and with me it is quite rare. Another species of *Diedrocephala* is new to Professor Van Duzee. This is much darker than either *mollipes* or *noveboraceusis*. Dr. C. V. Riley's *Diedrocephala floviceps* I have never taken, although it is recorded from New Jersey.

Helochara communis Fitch is by no means common here, but is represented by a dozen specimens.

Evacanthus orbitalis Fitch I have never collected, but no doubt it will be found here. *Tettigonia* is represented by two species, *bifida* Say and *tripunctata* Fitch, the former being the most common of the two species. *T. trifasciata* Say I have never found, but it is recorded from New Jersey, and no doubt occurs with us also.

In the sub-family ACOCEPHALINÆ I have three representative species. *Acocephalus mixtus* Say is represented by about half a dozen specimens. *Parabolocratus vittilinus* Fitch is very rare indeed, and *Platymetopius frontalis* Van Duzee is represented by three specimens. Professor Smith also records in this sub-family *Hecalus fenestratus* Uhl., *Acocephala solidaginis* Harr., *Platymetopius acutus* Say, *P. albonotatus* Fitch, and *Selenocephalus vittilinus* Fitch, now referred to *Parabolocratus* as above.

After extended examination and research, I am inclined to believe with Professor Osborn that what is known as

"Silver Top" in grass is caused by the working of leaf-hoppers, and that the *Jassidæ* furnish many of the insects as well as those in the families named in this paper. In our Park meadows, some of which are left to develop hay, "silver top" is very common, especially on the earlier grasses, and throughout the season a weakening and deforming of grass stalks are everywhere noticeable, which in most cases, no doubt, is due to the extraction of the juices by these insects. The node of the grass, especially on the upper side and for an inch or more, is very tender and succulent; but as we traverse the internode, we find it becomes more firm and woody, as it were. Every boy knows where to find the succulent portion of a grass-stem, and proceeds to pull it out, when it breaks just above the node at the tenderest place. This succulent feeding ground is soon discovered by the "hoppers" in their tours of prospecting up and down the stem; veritable "sappers, if not miners," they are often seen in numbers in such situations, and the punctures can also be noticed. The exhausted stems of the dead part of the grass culm show every sign of having been pumped dry by these creatures, as at that point nothing seems to be left but a bundle of woody fibres, and the internode for some distance diminishing in size from the loss of sap, and that loss occurring before the cells had been sufficiently developed to stand without collapsing. My success in finding Thrips, or Meromyza, in the stems or under the leaf-sheaths has been no better than Professor Osborn's.

As I am working on a list with food-plants and habits of Hemiptera for New York State, I should be glad to receive from collectors information in regard to those found here and their distribution elsewhere, so that the list can be made as complete as possible; for all "local lists" are of the greatest value, not only to local students but to students of North American entomology also. EDMUND B. SOUTHWICK.

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.*

On request in advance, one hundred copies of the number containing his communication will be furnished free to any correspondent.

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

Four-Fold Space and Two-Fold Time.

ANY attempt at expounding popularly the recent developments of the old idea of space should be prefaced by the explanation that their tremendous value to mathematics is utterly independent both of their external reality and of the possibility of their realization. For example, had either M'Clelland or Preston ever glanced through Bolyai's "Science Absolute of Space," we would not to-day read in their excellent "Treatise on Spherical Trigonometry," p. 10, "The student must be careful, however, not to regard a solid angle as an *area*, but as a mere *number*, like the circular measure of a plane angle. . . . and the solid angle subtended at O by the $\frac{1}{n^{th}}$ part of the surface of the sphere is $\frac{4\pi}{n^{th}}$, which is thus a *mere number*." A solid angle is a magnitude as different from a mere number as is the current of electricity which kills a man. Though its scientific unit, the *steradian*, is American, yet they could have found it in the "Encyclopædia Britannica, in William Thomson's article "Mensuration."

Because these magnitudes, solid angles, have a natural unit, the steregon, and a scientific subsidiary unit, the steradian, therefore mathematicians, unused to the idea of a natural unit, blunder about them. To Bolyai belongs the honor of showing that each geometric magnitude has its natural unit, which never could have been discovered in Euclidean space, since homaloidal, parabolic space appears as a limit in which the natural unit for length becomes indefinitely great, so calling, in practice, for an artificial unit for length, a finite sect, as the centimeter. The fundamental importance of the pseudospheric hyperbolic space of Bolyai and Lobatschewsky in no wise depends on whether C. S. Peirce is right in maintaining that such is the real space in which we live. It has already enriched us eternally by the gift of the Science of Comparative Geometry, and so of pure spherics.

Now, in his beautiful paper in Crelle, on "Single Elliptic Geometry," Professor Newcomb has used, unnecessarily we think, space of four dimensions. Elliptic space, though finite, is unbounded. But there is a sense in which hyperbolic space, though infinite, is bounded, and so its realization is naturally connected with that of four-fold space. For this the most fruitful idea has ever been Professor Sylvester's, of working up from two-dimensional beings. And here let me say that thinkers must not confine themselves as in the past to "an imaginary *plane* being," but must likewise draw from two dimensional spherics and pseudospherics. Not only must we think of a *flexible* closed shell turned inside out, as we turn a glove; we must try if we can realize that as the flexibility of the "thin hoop" mentioned by Dr. Hall is only needed because the hoop has as many dimensions as the space in which we wish to turn it, therefore can we not turn an inflexible closed shell, an unbroken eggshell, inside out, *without flexure?*

The corresponding generalizations for *time* are harder, because in time's domain we are one-dimensional beings; therefore our best space-method fails us. Cannot genius give us a next-best almost as good? GEORGE BRUCE HALSTED.

University of Texas, Austin, Tex., May 22.

Family Traits.

IN your issue of May 20, "Veritas" again combats the proposition that family traits are a reality. The statement was made in my original communication that questions of descent were questions of heredity and environment, and that heredity, consisting as it does of questions relating to the reproduction of the race as an animal, must be referred to biology. The results of all departments of research for the last fifty years refer man to his place in nature as an animal, and as an animal a fit subject for biological investigation.

Will Veritas please explain how, if it be admitted that a man may resemble his father and grandfather, that with the great-grandfather the resemblance must cease? Is not every man the son of his father, and is his father not also the son of his grandfather, and so on from generation to generation back in an infinite series? If a man may or does resemble his father, that is the limit of the question, and further argument is unnecessary.

I freely admit that the Does of the present know, of their own knowledge, nothing of 100 per cent of the traits of John Doe the first. I was not referring to any positive knowledge held in this generation of the ninth generation from the present. Nevertheless John Doe of the seventeenth century had personal traits, and if the oldest Doe now living has seen and known 100 Does in perhaps five generations, and affirms that, out of the almost infinite diversity of traits that constitute human character, a few have been observed in all these generations common to a large majority of the 100 Does, I assert that there are "Doe" traits or "family traits," and in my former article I gave a scientific explanation of the occurrence of such traits, with a number of illustrations that were neither a figment of the imagination nor a delusion. If these are not facts, what are facts?

Moreover, in your issue of April 15, Ed. H. Williams Jr. gave a number of other reasons why family traits should descend on the male side strongest, that are either "facts" or delusions. Facts are established by observation of the repeated recurrence of identical phenomena under like conditions.

What fact is developed by speculation concerning a man's ancestor of the seventeenth century relative to the occurrence of traits common to forty people now living, who all bear his surname, and who are likewise his descendants? Suppose these forty people *are* cousins to the entire population of Boston; does that relation either prove or disprove their possession of traits in common that do not appear among 40 other cousins of 40 different names?

ENQUIRER.

The Systematic Position of the Diptera.

In reply to the article, by Professor J. M. Aldrich, in *Science* of April 26, I will say that the Diptera are undoubtedly the most highly specialized order of insects. Professor Hyatt deserves credit for apparently being the first one to call attention to this idea and offer proofs to sustain it. His idea of what constitutes specialization is correct, from my standpoint. I realize the force of Professor Aldrich's remark, when he says that this line of reasoning will apparently lead us to the conclusion that the Pupipara are the highest insects; but I am inclined to believe that the higher families of Cyclorrhapha will be found to exhibit greater specialization. Everything points to their being of the most recent origin. If anything has been published on the the embryology of the Pupipara, I am not aware of it. Embryological research alone will clear up this point, and there is no reason in the world why it should not show that the Pupipara have long ago passed through stages now occupied by apparently more highly developed Diptera, but it is improbable, to say the least. If it can be demonstrated, I shall be glad to accept the Pupipara as the highest insects.

C. H. TYLER TOWNSEND.

Las Cruces, N. M., May 26.

A Botanical Congress and Botanical Nomenclature.

I HAVE read your note of May 20, with reference to the action of the Botanical Club of Washington upon the questions of a botanical congress and botanical nomenclature. It has always seemed to me wise for American botanists first to agree among themselves in reference to this matter, and then they will be in a better position to come to an understanding with the rest of the world. There is no more representative body of American botanists than the Botanical Club of the American Association. It is perfectly democratic; every botanist in the country can join it and take part in its discussions. It may be questioned whether its boundaries are not too ill-defined to make it a fit body to decide such important questions; but it is surely a capital place for their discussion.

JOHN M. COULTER.

Bloomington, Ind., May 25.

AMONG THE PUBLISHERS.

THE first number of the *Yale Review*, a quaterly journal of history and political science, has just been issued for the month of May. It is edited by Professor George P. Fisher and others of Yale University, but will welcome contributions from every quarter and from every school. The papers in this opening number are on "German Tariff Policy, Past and Present," by Henry Villard and Henry W. Farnam; on "The Demarcation Line of Pope Alexander VI," by E. G. Bourne; on "Legal

Theories of Price Regulation," by Arthur T. Hadley; on "Massachusetts and the Saybrook Platform," by Williston Walker; and on "Labor Troubles between 1834 and 1837," by Evans Woollen, together with a few pages of comment and a number of book reviews. The articles are essentially of the same quality as those that have appeared on similar topics elsewhere in this country during the past ten or twenty years, but we fail to find in them anything new or striking. The appearance of this new *Review*, indeed, raises the question whether this subject of political science is not in danger of being run into the ground by our young and ambitious writers. The *Review* is published by Ginn & Co., of Boston, at 75 cents a number or $3 a year.

— Professor W. O. Atwater, in an instructive article in *The Forum* for June, points out the curious fact, that, in the extraordinary applications of science to practical problems in recent years, one of the most important fundamental problems has been strangely overlooked, viz., the scientific study of food. The coming man will avoid four mistakes that are now largely made: (1) he will not buy as expensive kinds of food as are now generally bought, because some of the least expensive foods are the most nutritive and palatable; (2) with further scientific information the coming man will value foods in proportion to their nutritive qualities; (3) if foods are bought and eaten with reference to their nutritive qualities, and not to mere fashion or habit, it would require a much less quantity to keep a man in his best working condition than is now generally consumed; (4) there will be a revolution wrought in the present way of cooking, which is both wasteful and primitive and far behind our advancement in almost every other art. Professor Atwater gives the results of practical studies in diets made to show these conclusions. And he asks: "Has man yet reached his highest development? The poorer classes of people — and few of us realize how numerous they are — the world over are scantily nourished. The majority of mankind live on a nutritive plane far below that with which we are familiar. We may hope for the best culture, not of the intellectual powers, but of the higher Christian graces in the minds and hearts of men, in proportion as the care of their bodies is provided for. Happily, with advance of knowledge comes the improvement of material conditions. May we not hope that the future development of our race will bring that provision for physical wants which is requisite for the best welfare of mind and soul?" President Dwight, in his article, also in the June *Forum*, on the recent action of Yale College in admitting women to its advanced courses, makes an eloquent discussion of the higher education of women in the United States.

QUERY.

Can any reader of *Science* cite a case of lightning stroke in which the dissipation of a small conductor (one-sixteenth of an inch in diameter, say,) has failed to protect between two horizontal planes passing through its upper and lower ends respectively? Plenty of cases have been found which show that when the conductor is dissipated the building is not injured to the extent explained (for many of these see volumes of Philosophical Transactions at the time when lightning was attracting the attention of the Royal Society), but not an exception is yet known, although this query has been published far and wide among electricians.

First inserted June 19. No response to date.

N. D. C. HODGES,

874 BROADWAY, NEW YORK.

TO THE READERS OF SCIENCE.

PUBLISHER'S ANNOUNCEMENT.

OUR PLANS.

WITHIN the past six months the use of *Science* by scientific men and women as a medium for prompt publication and weekly discussion, has increased very materially, so that the pages are now well filled each week with original matter. As the number of those promising contributions is increasing at the rate of three or four each day, it cannot be long before *Science* at its present size will be too small for the amount of matter offered. We have under consideration therefore an enlargement of the paper by one-half, but must first learn the temper of our constituency as to an advance in price to $5.00, which was the subscription price from the start for four years, up to June 30, 1887. Further, to carry out the proposed enlargement, we shall need five hundred additional subscribers. If you are not already a subscriber, are you willing to aid in making *Science* more worthy of American scientific work by becoming one?

It goes without saying, that the demand for scientific literature is limited, when compared with that for literature which is more to the public taste, so that the receipts of most of the Scientific Journals, in this country, do not pay quite for their printing and paper, to say nothing of the other items of expense. We say this merely to emphasize the fact, that generous and prompt support must be accorded this move if it is to succeed.

Titles of Some Articles Published in *Science* since Jan. 1, 1892.

Aboriginal North American Tea.
Actinism.
Amenhotep, King, the tomb of.
Anthropology, Current Notes on.
Arsenical Poisoning from Domestic Fabrics.
Anatomy, The Teaching of, to Advanced Medical Students.
Astronomical Notes.
Botanical Laboratory, A.
Brain, A Few Characteristics of the Avian.
Celts, The Question of the.
Collection of Objects Used in Worship.
Deaf, Higher Education of the.
Diphtheria, Tox-Albumin.
Etymology of two Iroquoian Compound Stems.
Eye-Habits.
Family Traits, Persistency of.
Fishes, The Distribution of.
Fossils, Notice of New Gigantic.
Grasses, Homoptera Injurious to.
"Healing, Divine."
Hemipterous Mouth, Structure of the.
Hypnotism among the Lower Animals.
Hypnotism, Traumatic.
Indian occupation of New York.
Influenza, Latest Details Concerning the Germs of.
Infant's Movements.
Inventors and Manufacturers, the American Association of.
Iowa Academy of Sciences.
Jargon, The Chinook.
Klamath Nation, Linguistics.
Lightning, The New Method of Protecting Buildings from.
Lissajou's Curves, Simple Apparatus for the Production of.
Maize Plant, Observations on the Growth and Chemical Composition of.
Mineral Discoveries, Some Recent, in the State of Washington.
Museums, The Support of.
Patent Office Building, The.
Pocket Gopher, Attempted Extermination of.
Psychological Laboratory in the University of Toronto.
Psychological Training, The Need of.
Rain-Making.
Rivers, Evolution of the Loup, in Nebraska.
Scientific Alliance, The.
Star, The New, in Auriga.
Storage of Storm-Waters on the Great Plains.
Teaching of Science.
Tiger, A New Sabre-Toothed, from Kansas.
Timber Trees of West Virginia.
Tracheæ of Insects, Structure of.
Vein-Formation, Valuable Experiments in.
Will, a Recent Analysis of.
Wind-Storms and Trees.
Wines, The Sophisticated French.
Zoology in the Public Schools of Washington, D. C.

Some of the Contributors to *Science* Since Jan. 1, 1892.

Aaron, Eugene M., Philadelphia, Pa.
Allen, Harrison, Philadelphia, Pa.
Baldwin, J. Mark, University of Toronto, Canada.
Barnes, Charles Reid, Madison, Wis.
Baur, G., Clark University, Worcester, Mass.
Beal, W. J., Agricultural College, Mich.
Beals, A. H., Milledgeville, Ga.
Beauchamp, W. M., Baldwinsville, N.Y.
Boas, Franz, Clark University, Worcester, Mass.
Bostwich, Arthur E., Montclair, N J.
Bradley, Milton, Springfield, Mass.
Brinton, D. G., Philadelphia, Pa.
Chandler, H., Buffalo, N.Y.
Comstock, Theo. B., Tucson, Arizona.
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Ferree, Barr, New York City.
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Foshay, P. Max, Rochester, N.Y.
Gallaudet, E. M., Kendall Green, Washington, D.C.
Garman, S., Museum of Comp. Zool., Cambridge, Mass.
Golden, Katherine E., Agricultural College, Lafayette, Ind.
Hale, Edwin M., Chicago, Ill.
Hale, George S., Boston, Mass.
Hale, Horatio, Clinton, Ontario, Canada.
Hall, T. Proctor, Clark University, Worcester, Mass.
Halsted, Byron D., Rutgers College, New Brunswick, N.J.
Haworth, Erasmus, Oskaloosa, Iowa.
Hay, O. P., Irvington, Ind.
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Hicks, L. E., Lincoln, Neb.
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Hotchkiss, Jed., Staunton, Va.
Howe, Jas. Lewis, Louisville, Ky.
Hubbard, Gardiner G., Washington, D.C.
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Oliver, J. E., Cornell University, Ithaca, N.Y.
Osborn, Henry F., Columbia College, New York City.
Osborn, Herbert, Agricultural College, Ames, Iowa.
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Stevenson, S. Y., Philadelphia, Pa.
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Ward, R. DeC., Harvard University, Cambridge, Mass.
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Warder, Robert B., Howard University, Washington, D.C.
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West, Gerald M., Clark University, Worcester, Mass.
Williams, Edward H., Lehigh University, Bethlehem, Pa.

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SCIENCE

NEW YORK, JUNE 10, 1892.

DIRECT REFLECTING POLARISCOPES.

Polarization by reflection is more perfect than by transmission through thin plates, unless a large number of plates are used, and in that case there is difficulty in finding plates free from color. The disadvantages of reflection are (1) the "elbow" angle and (2) the impossibility of rotation of the polarized beam. Both these objections are overcome in the forms here described, which may be attached to the lantern by a sliding collar and rotated almost as easily as a Nicol.

In Fig. 1, p is a bundle of thin glass plates, set at the polarizing angle; m is a silvered mirror. Either the reflected

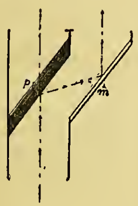

Fig. 1.

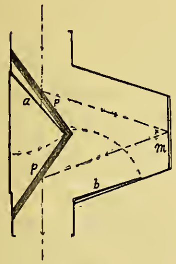

Fig. 3.

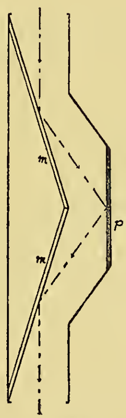

Fig. 2.

or the transmitted beam may be used; or, if the mirror is slightly movable, the two images may be thrown either side by side or superposed upon the screen.

In Fig. 2 the bundle of plates, p, has a black backing, and there are two silvered mirrors, m, m. The reflected beam only is used.

The form shown in Fig. 3 is more complicated and clumsy in appearance, but it has the advantage of keeping either the reflected or the transmitted beam, or both, in the axis of rotation. a and b are movable blackened screens.

T. Proctor Hall.

Clark University, Worcester, Mass.

Professor A. S. Hardy of Dartmouth, who has been spoken of for president of the college, has decided to leave Hanover and take a new professorship at West Point.

NOTES ON THE FERTILITY OF PHYSA HETEROSTROPHA SAY.[1]

On the 8th of March, 1886, I collected from a marsh near Wake Forest two specimens of Physa heterostropha Say. On the 16th three thick nidamenta, of some forty eggs each, were seen loosely attached to the walls of the glass aquarium. A few days later four others had been deposited. Up to June 15 the aquarium was examined at intervals nearly every day. After that date it was not seen again until July 12, when the water was changed. The next day both the snails were dead, probably as the result of the change of water.

In the period of four months — say March 12 to July 12 — the pair produced 43 nidamenta, which contained, on an estimate certainly not too high, an average of 30 eggs each, so that the number of their offspring for the period mentioned amounted to 1,290. There was no well-marked decline of the reproductive function toward the close of the period, which is perhaps another indication that they came to their death by violence.

From March 31 to June 6 inclusive, the pair were observed in coitu as many as fifteen times, at hours ranging from 8.30 a.m. to 6.15 p.m., the coitus lasting sometimes but twenty minutes, sometimes more than an hour. The male function was performed alternately by the two snails. The eggs appear to have been laid only during the night.

It was important to determine, if possible, the age at which sexual maturity is attained and reproduction begins. Accordingly, on the 12th of July I took out of the aquarium two of the largest of the young snails and put them into another aquarium. They were presumably members of the first brood, the eggs of which were deposited near March 13. Their age, reckoning from the time they were batched, was about 3½ months; size, length of shell, 5 millimetres; length of foot, 6 millimetres. In two days one of the snails was dead. On the 25th of July another snail of about the same size was introduced from the first aquarium. The next entry in my notes is under date of Sept. 11, when six nidamenta were observed attached to the fibrous roots of a water plant. They were, however, small, containing only from one to four eggs each, showing that the reproductive function at that age was feeble. Some of the eggs were already hatched, and the tiny grandchildren of my first Physas were going about the aquarium in search of food. Allowing, say, fifteen days for the intracapsular development of these snails of the third generation, I estimate that the isolated pair of the second generation attained sexual maturity at five months of age. The same day — Sept. 11 — in the first aquarium I noticed a confirmation of my observation in the second, namely, the pairing of two of the oldest brood.

The maintenance of a species depends on the equilibrium between the forces tending to its destruction and those tending to its preservation. We may enbrace the former under the general phrase, adverse external conditions. There are two different ways in which the destructive tendency of these adverse external conditions is opposed. The first is by adap-

[1] Abstract of a paper read before the Elisha Mitchell Scientific Society in session at Wake Forest, . ., Oct. 23, 1891.

tations of structure and habit. The second is by the production of new individuals to take the place of those that have been overcome. Now, as different animals exhibit varying degrees of ability to adjust themselves to their environment, so also their reproductive power may be small or great. In estimating this reproductive power four factors, as Herbert Spencer points out,[1] are to be taken account of, namely, (1) the age at which reproduction commences, (2) the frequency with which broods are produced, (3) the number contained in each brood, and (4) the length of time during which the bringing forth of broods continues.

Accordingly, for the special case of Physa heterostropha we have the following results: —

1. Age at which reproduction begins, 5 months.
2. Frequency of broods, 1 in about $2\frac{7}{10}$ days.
3. Number in each brood, 30 average.
4. Reproductive period, 4 months, March to July.

Some addition ought to be made to this actually observed period, inasmuch as the snails had certainly already entered upon it at the time of their capture, and, further, instead of closing normally, it seems to have been violently interrupted. Just how much the period of reproduction is to be extended I have no means of determining, unless the fact that the young snails of the first brood were observed reproducing themselves in September warrants an extension of at least two months, making it six months instead of four.

Assuming, then, that the reproductive season extends from March to September, and assuming, further, somewhat arbitrarily, that the snail lives but two years, we have, on the basis of facts above mentioned, the following estimate of the total number of the offspring of a single pair: —

At close of first season	1,900
950 pairs at close of second season	1,805,000
Original pair at close of second season	1,900
Total number of offspring in two years	1,808,800

W. L. Poteat.

Wake Forest College, N.C.

NEBRASKA SUGAR SCHOOL.

Professor Lloyd has just made the first formal report of the sugar school at the State university, Lincoln, Neb., of which the following is a summary: The school opened on Jan. 5 with an enrollment of twenty-five students. These students were mostly members of other classes in the chemical department of the university; the only preparation required for entrance being a clear conception of the principles of elementary chemistry, such as may be obtained in some of the high schools of Nebraska.

The course consisted of two lectures a week, with five hours of laboratory work. The lectures as given by Mr. Lyon embraced the following subjects: 1. Chemistry of the sugars; 2. technology of beet-sugar manufacture; 3. culture of the sugar beet.

The lectures under the first head were designed to give the students an idea of the position of sugars as a class in the series of compounds of carbon, and their relation to others of these compounds, together with a knowledge of the properties and characteristics of each of the sugars.

The cause and effects of fermentation upon sugar solutions were carefully studied. Other important principles relating to the manufacture of sugar, as the compounds of the sugars with lime, melassigenic action, etc., were taken up in order to prepare the student for the complete understanding of the practical application of these principles in sugar factories.

A discussion of the methods of the analysis used in the laboratory was given from time to time throughout the course.

Under the second head of lectures, the various processes that the beets, juice, and sugars undergo from the washers to the granulator were studied in detail. Both the French and German forms of machinery were described. As each process was studied, the methods of the analysis of its products and by-products was referred to. The study of sugar-house control was in this way presented to the student.

During the latter part of the winter term, Professor DeWitt B. Brace gave the class four valuable lectures on the theory of light. His lectures included the following subjects: 1. The wave theory of light; 2. polarization of light; 3. rotation of the plane of polarization; 4. application of these principles to the polariscope and to the different forms of saccharimeters.

The lectures were finely illustrated by means of the apparatus in possession of the physical laboratory. This course in the physics of light was followed by lectures in the chemical department on the use of the saccharimeter, methods of setting prisms to obtain a clear field, adjustment of the compensating wedges, methods for testing the accuracy of instruments.

The laboratory work of the course consisted in analyses of the various products and by-products of the sugar factory. The samples used were obtained from the Norfolk sugar factory during the last campaign. One of the students did some advance work in the absorption of sucrose by bone black and the volume of the lead precipitates.

The spring term was devoted to a course of lectures on the culture of the beet. This course embraced the following topics:

1. Origin and history of the beet.
2. External characteristics of a good sugar beet, its roots and foliage.
3. Composition and structure of the root.
4. Relation of the leaves to the root.
5. Food of the plant.
6. Relation of the plant to the atmosphere and to the soil.
7. Conditions governing the growth of the plant, and changes during vegetation.
8. Fertilizers, preparation of the soil, planting, cultivating, thinning, etc.
9. Production and improvement of the seed.

These lectures were supplemented by practical work at the station farm, which may be continued throughout the summer at the option of the student. The course closed May 6.

Encouraged by this prosperous beginning of the first beet-sugar school in the United States, it is hoped that in the coming year the work may be greatly extended. Several students who have taken the course outlined are thoroughly prepared to do polariscopic work in sugar factories.

SECONDARY BATTERIES.[2]

When a lead-peroxide cell is discharged, sulphate of lead is the ultimate product on both plates, and when it is charged again this lead sulphate is oxidated on one plate and reduced on the other. This fact was published in 1882 by Dr. J. H. Gladstone and the late Mr. Tribe in *Nature*. Taken by itself, however, it does not explain how it is that during charge the potential difference of a cell will rise rapidly from 2.1 volts to 2.13 volts, then slowly to 2.2 volts, and

[1] Biology, Vol. II., p. 395.

[2] From Engineering of May 20.

afterwards rapidly to 2.4 volts, or even higher. Upon disconnection of the charging current the potential difference drops suddenly to about 2 1 volts, and then on discharge falls rapidly to 1.95 volts. The main part of the discharge takes place between 1.95 and 1.9 volts, and if it be continued beyond the latter point the potential difference rapidly falls to 1.6 volts, the gradient below 1.8 volts being very steep. Last week, and again yesterday, Dr. Gladstone showed the Institution of Electrical Engineers that the variations in the strength of the sulphuric acid are the main causes of the variations in the electro motive force. Starting with a properly formed cell which has been discharged, there are two leaden supports; on one of these is a mixture of lead sulphate ($PbSO_4$) with more or less lead peroxide (PbO_2); on the other is also a mixture of lead sulphate with more or less of spongy metallic lead. Each of these mixtures is a porous layer. The act of charging converts the lead sulphate on one plate into PbO_2, and on the other into spongy lead. In the operation there is an abundant formation of sulphuric acid in the pores of each plate, while an equivalent amount of water disappears. In addition to this chemical effect sulphuric acid is, by electrolytic action, heaped up against the positive (peroxide) plate, and withdrawn from the neighborhood of the negative (spongy lead) plate. The increase of acid strength around the positive plate was proved experimentally by the author, while it is matter of common knowledge that the density of all the liquid in a cell rises during charge.

When a cell is fully charged and left to stand, the strength of the acid commences to equalize itself through the liquid. This is brought about by three causes — diffusion, local action, and reduction by H_2O_2. These actions occur at the positive plate, where the acid in the pores works out, at first rapidly and then more slowly. At the same time energetic local action is set up between the PbO_2 and its supporting lead frame, with the formation of sulphate of lead, and the consequent absorption of sulphuric acid from the liquid. The temporary evolution of oxygen gas from a well-charged plate has been attributed to the reaction of hydrogen dioxide on peroxide of lead. At the negative plate equalization of acid strength takes place by diffusion, and also by a direct, slow, chemical action of the sulphuric acid on the lead, producing lead sulphate and hydrogen gas. This latter gas, being formed in the pores of the spongy lead, chokes them and hinders the diffusion of the acid, rendering it very slow.

During the discharge of a cell all the causes just enumerated as tending to produce equalization of acid strength, continue in operation, and to them is superadded the ordinary discharge reaction of the cell. At the positive plate the lead peroxide, with sulphuric acid existing in its pores ($PbO_2 + H_2SO_4$), becomes sulphate of lead and water ($PbSO_4 + H_2O$). At the negative plate spongy lead with sulphuric acid in its pores ($Pb + H_2SO_4$) also becomes sulphate of lead and water ($Pb\,SO_4 + H_2O$). Further, by electrolytic action sulphuric acid is transferred from the PbO_2 to the Pb plate. The excess of acid originally about the PbO_2 plate rapidly disappears by these various agencies, and the acid on both plates is reduced pretty nearly to the same strength as that of the intermediate liquid. After this there is a gradual withdrawal of acid from the liquid in the pores, more or less compensated by diffusion inwards from the intermediate liquid. This brings about the reduction in the strength of the whole acid, which is well known to take place during discharge. The strength of the acid in the pores will be determined by the relative values of the rate of withdrawal and the rate of diffusion. But while the rate of withdrawal continues constant for a given current discharge, the rate of diffusion rapidly diminishes. The rate of weakening of the acid is, therefore, a constantly increasing one, and may finally become so rapid that the acid strength of the liquid against the working surfaces of the plates is very low, or almost *nil*.

It being shown that the strength of the acid against the plates of a secondary battery is constantly varying during charge, repose, and discharge, the authors of the paper, from which we have quoted, set themselves to prove experimentally that a change of electro-motive force is produced by a change in the strength of the acid. Taking a pair of fully formed and carefully washed plates they were placed in a series of solutions of gradually increasing strength of acid, and left in each for fifteen minutes. The acid strengths and electro-motive force are given in the following table: —

Percentage of Acid.	Electro-motive Force (Volts).
6.5	1.887
9.5	1.898
11.5	1.915
16.2	1.943
21.7	1.978
29.2	2.048
33.7	2.088
43.0	2.170

In a second set of experiments the Pb plate was kept in acid of 14.0 per cent strength, while the acid around the positive plate was varied from 6.5 to 81 per cent. The result confirmed those of the first set of experiments, but it was shown that the electro-motive force depends on the strength of the acid at both electrodes. Several other series of experiments were made in different ways, but all confirming the opinion that change in acid density was accompanied by a change of electro-motive force.

We have not space to follow Messrs. Gladstone and Hibbert through the vast amount of confirmatory evidence they adduced from their own experiments, and from the records of the researches of others, in support of their hypothesis. We may, however, notice one point. Applying Lord Kelvin's law as to the relation between the electro-motive force of a cell, and the thermal value of the chemical actions contributing to it, they find that the voltage of a PbO_2 — Pb cell, in which there was nothing but pure H_2So_4, would be 2.627; by experiment they made it 2.607 volts. With pure water in the cell the result is, by calculation, 1.35 volts; by experiment, 1.36 volts. In charging an accumulator the current has, as already shown, to do extra work in concentrating H_2SO_4 at the PbO_2 plate, and the energy equivalent to that work must be obtained from an increased potential difference. This explains how it is that potential difference is so much greater during charge than during discharge. For a dyad gramme equivalent of H_2SO_4, concentrated from a 10 per cent solution to 100 per cent, about 17,000 calories will be needed, equal to .37 of a volt. The calculated charging electro-motive force must, therefore, be at least 2.3 volts.

The lesson to be learned from the paper is the desirability of promoting diffusion in the liquid of the cell, so as to keep the whole of the same density. At present the heavy acid slides down the PbO_2 plate and accumulates at the bottom. This leads to differences of current density in different parts of the plate, and will also give rise to potential differences on each of the plates, and thus produce local action and the formation of lead sulphate. It would not be a difficult matter to effect such diffusion, and the experiment would be one of considerable interest.

NOTES AND NEWS.

THE annual meeting of the Society of German Men of Science and Physicians, according to *Nature*, will be held at Nürnberg from September 12 to 18. At the same time and place there will be a meeting of the German Mathematical Association. In connection with these meetings there will be a mathematical exhibition, including models drawings, apparatus and instruments used in teaching and in research in pure and applied mathematics. The project has the support of the Bavarian Government, and those who are organizing the exhibition have secured the coöperation of various competent men of science, and of the mathematical departments of some colleges, besides that of prominent publishers and well-known technical institutions. Space will be granted free of charge to exhibitors.

— Mr. E. H. Parker, the British consul at Kiungchow, in Hainan, a large island off the southern coast of China, mentions a curious phenomenon in connection with the tides of that port. The tides inside the inner harbor, as we learn from *Nature*, require several years of careful observation before they can be tabulated. It appears certain, however, that there are always two tidal waves a day, though one is so much more considerable than the other that the effect is often practically that of one single tide in the twenty four hours. The easterly and westerly currents through the straits are not necessarily connected with the rise and fall of the water, either there or in port. The phenomenon of "slack water" (*morte eau*) is also observable every ten days or so at Haiphong, and is probably owing to much the same causes as at Hoihow. At Tourane in Tonquin, too, it is popularly thought that there is usually but one tide within the twenty-four hours. This tide is felt away up to the citadel of Quangnam. In the Gulf of Tonquin the incoming tidal wave flows from the south, a fact which perhaps accounts for the singular circumstance that the westerly current in the Hainan Straits always sets for sixteen hours. One at least of the tidal waves from the east, which pass Hoihow, cannot get through the straits to Tonquin so soon as that portion of the same wave which takes a circuitous course by way of Annam.

— A Report of the State Geologist of Missouri, dated June 3, shows that much attention has been given to the study of the zinc and lead deposits, and in this connection examinations have been made in Jasper, Newton, Lawrence, Greene, and St. Francois Counties. In addition, detailed mapping has been prosecuted in Jasper County, and about 140 square miles have been covered during the past month. Further, there has been collected in Jasper County a large number of charts showing the location of mining properties, shafts, and ore bodies; and a great amount of statistical matter relating to these. The material thus acquired will be used in the preparation of the general report upon the zinc and lead deposits and also in the special report which will accompany the maps of Jasper County, now in preparation. In connection with the examination of the iron-ores, stratigraphic studies of the Ozark region have been prosecuted along the Big Piny and Gasconade Rivers in Texas, Pulaski, Phelps, Maries, Osage, and Gasconade Counties. In addition, iron-ore deposits have been inspected in Ripley, Carter, Wayne, and Butler Counties. The clays of the State have been subjects of further examination in both the field and the laboratory, deposits having been visited in St. Louis, Jefferson, Washington, Madison, Bollinger, Carroll, Chariton, and Randolph Counties. The study of the Quaternary geology of the State has been prosecuted in Jackson, Lafayette, Johnson, Macon, Randolph, and Saline Counties. In Greene and Polk Counties a small amount of systematic geological mapping has been done. The excessive rains during the past month have not only made all the field-work difficult and disagreeable, but have made certain work impossible, and have materially retarded the progress in other directions. It is greatly to the credit of the assistants of the survey that, notwithstanding the hardships endured and the difficulties overcome, such advance has been made. In the office the preparation of reports has been constantly in progress. This includes the original composition, the revision, and preparation for the printer, the correction of proof, the drawing of maps and illustrations. The reports which have thus specially received attention during the past month are: the report on the iron ores; the report on the mineral waters; the report on paleontology; the report on the Higginsville sheet; the reports on the Warrensburg, Iron Mountain, and Mine La Motte sheets; and the report on the crystalline rocks.

— At a meeting of the American Philosophical Society, Philadelphia, May 20, the following preambles and resolutions were read and considered: "*Whereas*, This Society did in the year 1843 celebrate the Centennial Anniversary of its foundation by a series of addresses, meetings, receptions, exercises, etc., upon the 25th, 26th, 27th, 28th, 29th, and 30th days of May, the results of which were published in a special volume of over two hundred pages; and, *Whereas*, We are approaching the Sesqui-Centennial Anniversary of the same auspicious event; therefore, be it *Resolved*, That the Society will celebrate the same in a worthy and becoming manner. *Resolved*, That the president be authorized to appoint a committee of five members to make all necessary arrangements for the same and with full power to act, and that the president be *ex-officio* a member of said committee." The preambles and resolutions, being considered by the society, were unanimously agreed to. The president subsequently appointed as said committee Messrs. Henry Phillips, Jun., chairman, J. Sergeant Price, Daniel G. Brinton, Richard Vaux, and William V. Keating.

— The usual monthly meeting of the Royal Meteorological Society was held on Wednesday evening, May 18. The following papers were read: (1) "Raindrops," by Mr. E. J. Lowe, F.R.S. The author has made over three hundred sketches of raindrops, and has gathered some interesting facts respecting their variation in size, form, and distribution. Sheets of slate in book-form, which could be instantly closed, were employed; these were ruled in inch squares, and after exposure the drops were copied on sheets of paper ruled like the slates. Some drops produce a wet circular spot; whilst others, falling with greater force, have splashes around the drops. The same-sized drop varies considerably in the amount of water it contains. The size of the drop ranges from an almost invisible point to that of at least two inches in diameter. Occasionally large drops fall that must be more or less hollow, as they fail to wet the whole surface inclosed within the drop. Besides the ordinary rain drops, the author exhibited diagrams, showing the drops produced by a mist floating along the ground, and also the manner in which snowflakes, on melting, wet the slates. (2) "Results of a Comparison of Richard's Anémo-Cinémographe with the Standard Beckley Anemograph at the Kew Observatory," by Mr. G. M. Whipple. This instrument is a windmill vane anemometer, and is formed by six small wings or vanes of aluminium, four inches in diameter, inclined at 45°, rivetted on very light steel arms, the diameter of which is so calculated that the vane should make exactly one turn for a meter of wind. Its running is always verified by means of a whirling frame fitted up in an experimental room where the air is absolutely calm, and, if necessary, a table of corrections is supplied. The recording part of the apparatus differs entirely from any other anemometer, and is called the Anémo-Cinémographe, and in principle is as follows: The pen, recording on a movable paper, is wound up at a constant rate by means of a conical pendulum acting as a train of wheel-links, whilst a second train, driven by the fan, is always tending to force it down to the lower edge of the paper; its position, therefore, is governed by the relative difference in the velocity of the two trains of wheel-work, being at zero when the air is calm, but at other times it records the rate of the fan in meters per second. The author has made a comparison of this instrument with the Standard Anemometer at the Kew Observatory, and finds that it gives exceedingly good results. (3) "Levels of the River Vaal at Kimberley, South Africa, with Remarks on the Rainfall of the Watershed," by Mr. W. B. Tripp. Measurements of the height of the River Vaal have for several years past been made at the Kimberley Waterworks. These gaugings having been placed at the disposal of the Society, the author has compared them with the rainfall of the watershed. There is a marked period of floods and fluctuations at a comparatively high level from about the end of October to the latter part of April, and a period of quiescence, during which the river steadily falls with very slight fluctuations, from about Apr. 19 to Oct. 31. The highest flood, 525 feet, occurred in 1880, the next highest being 500 feet on Jan. 24, 1891.

— The admirable results which have attended the artesian borings in the Wed Rir, at Wargla, and more recently at El Golea in the Sahara, have led to a demand being made by the inhabitants of the Mzab in the southern part of the French Sahara, for the assistance of the Government in undertaking experimental borings in that region also. M. G. Rolland, one of the few geologists who have explored the Algerian Sahara, and the only one who has visited the extreme south, makes the following observations, reported in the Proceedings of the Royal Geographical Society, on the régime of subterranean waters between Laghuat and El Golea. From the north to south in the region of the Laya, and on the chalk plateau which extends to the south, borings have no chance of success. In the shebka of the Mzab and of Metlili, the conditions are only moderately favorable, and it would be necessary to penetrate down to 700, and even to 1,000, feet. To the south of the 32d parallel the chances of success increase in what M. Rolland calls the shebka of the south of El Hassi. Borings would undoubtedly succeed in the depressions of Dayet Tarfa, El Aref, Zubia, and Bu Fakrun. Further south, springing water would be obtained along the western border of the chalk reliefs, which is unfortunately complicated by the ramifications of the Western Erg, and the depths of the borings would go on decreasing until, on approaching the region of El Golea, it would be necessary to penetrate down only to 400 feet.

— The United States Consul-General at Seoul, in his last report, says that paper manufacture is one of the leading industries of Corea. This paper is highly esteemed, and always forms part of royal presents, and of the tribute paid to China. Besides its use for writing and for books, it is employed in a great diversity of ways. It serves as string, and in the manufacture of lanterns, fans, umbrellas, shoe soles, hats, boxes, and coats. It is also used for covering floors, walls, and ceilings, and, stretched on frames, supplies windows and doors. It is highly prized in China and Japan, and is especially sought after for the manufacture of umbrellas. It is made from the bush of the mulberry order (*Broussonetia papyrifera*), which is indigenous, growing in many parts of the kingdom, but thriving best in the moist, warm climate of the south. It is chiefly grown from cuttings for this especial purpose, and the wild and cultivated plants are said to be of equal value. The bark, which alone is used, is generally gathered in the spring, and it is boiled for a long time in water, in which a quantity of wood ashes has been mixed, until it becomes a pulp, the mass having been beaten during the whole time of the boiling. Fine bamboo screens are then placed in shallow wooden vats, and a ladleful of the pulp is evenly spread over the screen by a dexterous circular motion of the hand. This operation is repeated once or twice, or as often as may be necessary—the more frequent the operation, the finer the paper—and the screen allowed to drain into the vats, until a proper consistency is reached, the drippings being thus saved. They are placed on a hot *kang* floor to dry. After the drying has proceeded far enough, the paper is laid on a hot floor, and ironed by hand. The long lines in the paper show strands of the bamboo screens, and their nearness, distinctness, or absence indicate the fineness or otherwise of the paper. They are almost imperceptible in some grades of paper, while in others they are distinct and far apart. Paper is made by the Paper Guild, a numerous and prosperous association. The province of Chulla is the chief seat of manufacture.

— The statement is sometimes made, that, owing to the homogeneity of steel, a bar of this metal with a surface crack or nick in one of its edges is liable to fail by the gradual spreading of the nick, and thus break under a very much smaller load than a sound bar. With iron it is contended this does not occur, as this metal has a fibrous structure. Even the late Sir William Siemens supported this theory, and likened a bar of steel to one of india-rubber, which, as everyone knows, is greatly weakened by a nick in one of its edges. Sir Benjamin Baker has, however, shown that this theory, at least so far as statical stress is concerned, is opposed to the facts, as he purposely made nicks in specimens of the mild steel used at the Forth Bridge, but found that the tensile strength of the whole was thus reduced by only about one ton per square inch of section. This settled the matter so far as statical stresses are concerned, and we now find in a recent number of *Engineering News*, an account of an experiment carried out by the Union Bridge Company, in which a full-sized steel counter-bar, with a screw-turned buckle connection, was tested under a heavy statical stress, and at the same time a weight weighing 1,040 pounds was allowed to drop on it from various heights. The bar was first broken by ordinary statical strain, and showed an ultimate breaking stress of 66,800 pounds per square inch, with an elongation of 29.17 per cent on 12 inches. The reduction of area at fracture was 52.4 per cent. The longer of the broken parts was then placed in the machine and put under the following loads, whilst a weight, as already mentioned, was dropped on it from various heights at a distance of five feet from the sleeve nut of the turn buckle as shown below:—

Stress in pounds per square inch...	50,000	55,000	60,000	63,000	65,000
	ft. in.	ft in.	ft. in.	ft. in.	ft. in.
Height of fall........................	2 1	2 6	3 0	4 0	5 0

The weight was then shifted so as to fall directly on the sleeve nut, and the test proceeded as follows:—

Stress on specimen in pounds per square inch........	65,350	65,350	68,800
	ft.	ft.	ft.
Height of fall..	3	6	6

It will be seen that under this severe trial the bar actually carried more than when originally tested statically, showing that the nicking of the bar by screwing had not appreciably weakened its power of resisting shocks.

— The Councillor of Exploration of the Appalachian Mountain Club asks the assistance of members of the club during the coming season. Record of exploration in any part of the country will be welcome. In the White Mountains the whole region drained by the East Branch of the Pemigewasset needs exploration, especially in regard to the details of ravines, ridges, and minor summits; Mounts Thompson and Hastings have not yet been visited; and the region north and east of the Androscoggin has had but little attention except in the neighborhood of Gorham and Shelbourne. Members are requested to forward accounts of their visits to all places outside of the track of the ordinary tourists to A. L. Goodrich, Salem, Mass.

— The president of the Commission appointed to collect funds for the erection of a monument to the late G. A. Hirn, at Colmar, Alsace, are calling in the subscriptions, which are now nearly sufficient for the purpose. American subscribers should immediately send theirs to the nearest collector in this country. The sums subscribed abroad amount to from a few marks to several hundred, according to the ability of the subscribers. None is so poor but that he can add his mite. It is hoped that the opportunity to testify, in this country, the appreciation of America and of Americans, and their desire to honor the great genius of Alsace will be taken full advantage of. Contributions may be sent either directly to the president of the Commission, Mon. G. Kern, Colmar, or to either member of the committee in this country. The privilege of taking part in this movement is one not to be measured by money. Numerous small contributions are more desired by the management than a few large ones, and every friend and admirer of Hirn should send his mite.

— Since 1883, says the *Scottish Geographical Magazine*, the Dutch Government has been carrying out a triangulation of Western Sumatra, and at the end of 1890 the network had been extended over an area of more than 10,000 square miles, while some points had been determined in the northern part of the Padang lowlands and the south of Tapanuli. The base-line extends from Gunung Gadut to Pulau Satu, and is about 112,504 feet, but owing to a probable error of more than 3¼ feet, it must be measured again.

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A BRIEF STUDY OF THE PALENQUE TABLET.

IN order to assist students in their efforts to interpret the inscription on this tablet, I notice here some discoveries which may possibly lead to valuable results in this direction. However, to bring this article into proper limits and avoid the necessity of introducing tables and diagrams, I must take it for granted that the readers have access to my "Study of the Manuscript Troano" and to Dr. Rau's "Palenque Tablet" and refer them thereto. The only figures referred to are that of the entire tablet, and the photograph of the right slab, both in Dr. Rau's work. A copy of the first will also be found in my "Study MS. Troano." I will also have occasion to refer to the Calendar Table V, p. 11, and the diagram of Dr. Rau's figure of the tablet, on p. 199, of the "Study MS. Troano."

The order in which the characters on the tablet are to be read is as given in the same work, pp. 200–201. That is to say, the columns are taken two and two, commencing at the top and reading from left to right across the two until the bottom is reached, then going to the top of the next two which stand to the right. Thus it will be seen that the character at the bottom of the second column will be followed by the top character of the third column, the bottom one of the fourth by the top one of the fifth. As we will have occasion to refer only to the columns at the sides, it is unnecessary to refer to the central portion.

The particular point to which I wish to call attention at present is that the particular manner of reckoning the days of the month, found in some of the series of the Dresden Codex, notably the extensive one on Plates 46–50, is found on this tablet. The peculiarity of this method is that the day of the month is counted not from the first of the given month, but from the last of the preceding month; thus, the fifteenth day of Pop, beginning the count with the first, will, according to this method, be numbered 16.

I will now refer to the tablet to confirm this statement.

Turning to the right slab and to our diagram (Study MS. Tro., p. 199) we observe that the columns of this part are taken in pairs thus: ST, UV, and WX. The character 10 S is 11 *Lamat.* The little loops by the side of the outer 1 of the 11 are apparently of no significance, being left as mere ornamental supports or protection to the single numeral. I will not stop at present to give the proof of this, as the student will soon learn it for himself. Moreover, it is evident that they form no part of the numerals and hence have no bearing on the question now before us. The character 10 T, immediately to the right of the 11 *Lamat* above mentioned, is beyond question, 6 *Xul.* The two characters taken together are to be interpreted "11 Lamat the 6th day of the month Xul." Turning now to our Calendar Table (Study MS. Tro., p. 11) we see that Lamat is never the 6th day of the month according to the usual method of counting, but is the fifth day of the month in the Kan years. If the count were to begin with the last day of the preceding month it would then be the 6th, as here numbered.

Characters 17 T and 1 U form another pair. The first (17 T) is unquestionably 8 Ahau, but the month symbol, 1 U, has not been determined; however, the number attached to it is clearly 13. Ahau is never the 13th day of the month but is the 12th in Muluc years. Here, again, counting from the last day of the preceding month agrees with the numbering on the tablet. Symbols 17 U and 17 V are 5 Kan the 12th day of the month — ? — (probable Kayab as the character contains the phonetic elements *k* and *b*). Kan is the 11th day of the month in *Ix* years, therefore the same method of numbering is followed in this instance.

We notice a few other examples briefly.

Symbols 5 X and 6 W.—The first 1 Ymix, the second the 4th day of the month — ? —. Ymix is the 3d day of the months in the Cauac years. We refer next to 10 X and 11 W; the first is 7 Kan, the second the 17th day of the month — ? — (possibly *Uo* or *Mol*). Kan is the 16th day of the month in Muluc years. Attention is called next to 8 T and 9 S; where the first is 1 Kan and the other the 2d day of the month, — we have suggested may be Kayab. Kan is of course the first day of Kan years, but is never the second day of a month. In 7 U and 7 V we have 3 Ezanab, the 11th day of the month Xul. Ezanab is the 10th day of the month in Muluc years.

Turning now to the left slab of the tablet we notice the following, though with less assurance than in reference to those named, as here we have no photograph. The first two we call attention to are 16 A and 16 B, the first of these is 1 Ahau, the second the 13th day of the month Xul (?). Ahau is the 12th day of the month in Muluc years. Next 3 D and 4 C. The first of these is 4 Ahau, the second the 8th day of the month — ? — (probably Cumhu). Ahau is the 7th day of the month in the Ix years. Next 9 C and 9 D. Here the first is 13 Ik, the second has no number attached to it, hence we can only guess that it is a month symbol; nevertheless, it is a curious coincidence that precisely the same method of notation is found once on plate 48 and twice on plate 50 of the Dresden Codex, no number-symbol being attached where the day is, according to this method of counting the 20th of the month. As Ik is the 19th day of the month in the Kan years, it would, according to this method, be counted the 20th, and no number-symbol would be given. I think it possible that the symbol 9 D is that of the month Pop. The pair immediately to the right, 9 E and 9 F, in which the first is 9 Ik, present the same peculiarity.

Referring to 1 E and 1 F, we see 9 Ik, and the 15th day of the month. Ik is the 14th day of the month in the Muluc years.

These examples are sufficient to render it more than probable that the method of numbering the days of the month on this tablet is as suggested. If so it limits very greatly the field of search for the interpretation of the unknown characters following the days mentioned, as we have a satisfactory reason for believing they are month symbols.

This, however, is not the only advantage gained. Take, for example, the symbols 10 S and 10 T, in regard to which there is no reasonable doubt. These indicate 11 Lamat, the 6th (5th) day of the month Xul. This combination can only occur once in a cycle of fifty-two years, to wit, in the year 10 Kan. From this and what is stated above we can safely infer that the four-year system and consequently the year of 365 days was in use in this ancient city when the tablet was made. These facts, if such they be, and the evidence of the peculiar method of numbering the days of the month, lead to the inference that there were intimate relations between the people of this city and those where the Dresden Codex was written, and that there is no very great difference in the ages of the two documents.

I can give other data in reference to the interpretation of this noted inscription, but will not ask further space in *Science* at this time. I will simply add that the phonetic value of the *hand* symbol which so frequently occurs is probably *Ch*. CYRUS THOMAS.

THE NEW ELEMENT, MASRIUM.[1]

FURTHER details concerning the new element, whose probable existence was announced in a paper communicated to the Chemical Society at their meeting on April 21, are contributed to the number of the *Chemiker Zeitung* dated May 11. The mineral containing the new substance was discovered in 1890 by Johnson Pacha in the bed of an old river in Upper Egypt long since dried up, but of the former existence of which there are records dating back some 6000 years. Indeed, the name by which it is known in the neighborhood is "Bahr-bela-Mā," or "river without water." Here and there in the track of the old watercourse are small lakes whose water is of considerable repute for its medicinal value. Specimens of the mineral were sent by Johnson Pacha to the Khedivial Laboratory at Cairo, where it was examined by Messrs. H. Droop Richmond and Hussein Off, the authors of the paper laid before the Chemical Society. The mineral is found to be a fibrous variety of a mixed aluminium and iron alum containing ferrous, manganous, and cobaltous oxides. In addition, however, to these ordinary constituents, a small quantity of the oxide of another element would appear to be present, having properties entirely different from those of any yet known. This element the discoverers have termed *masrium*, from the Arabic name for Egypt, and the mineral has accordingly received the name of *masrite*. The symbol adopted for masrium is Ms.

The composition of masrite may be expressed by the formula $(Al, Fe)_2O_3 \cdot (Ms, Mn, Co, Fe)O \cdot 4SO_3 \cdot 20H_2O$. The amount of masrium present is very small, averaging only about 0.2 per cent, but by working upon fifteen kilograms of the mineral a considerable quantity of the element in the form of various salts has been accumulated A typical analysis of masrite published in the Proceedings of the Chemical Society is as follows:—

Water	40.35
Insoluble matter	2.61
Alumina	10.62
Ferric oxide	1.63
Masrium oxide	0.20
Manganous oxide	2.56
Cobaltous oxide	1.02
Ferrous oxide	4.23
Sulphuric oxide	36.78
	100.00

Suspicions that the mineral contained some hitherto unknown constituent were first aroused by the fact that when it was dissolved in water, and sulphuretted hydrogen was passed slowly through the solution in presence of acetic acid, instead of the expected black precipitate of sulphide of cobalt a white insoluble substance was first precipitated. This white precipitate continued to form until the new substance in the solution was all used up, when black sulphide of cobalt began to be thrown down. By decantation before the formation of the latter, and subsequent washing with dilute hydrochloric acid, the white substance was isolated in a state of tolerable purity. It was found to dissolve in boiling nitrohydrochloric acid. The solution in *aqua regia* was evaporated in order to remove the excess of acid, and ammonium hydrate added, when a voluminous white precipitate of the hydrate of the new metal was thrown down. The hydrate was washed by decantation, and subsequently dissolved in the minimum excess of sulphuric acid. The solution of the sulphate of the new metal was next evaporated to syrupy consistency, water was added until complete solution was just effected, and the solution mixed with an equal bulk of alcohol. The effect of this addition of alcohol was to cause immediate precipitation of crystals of the sulphate of the new metal, a further crop of which was also obtained upon evaporation. By repeated recrystallization most of the small quantity of iron present was removed. In order to eliminate the last traces of admixed ferrous sulphate, the crystals were redissolved in water, and excess of sodium hydrate added. As the hydrate of the new metal is soluble in excess of soda, the hydrated oxide of iron was readily removed by filtration. Upon the addition of ammonium chloride the white hydrate was precipitated in a gelatinous form; the hydrate was redissolved in hydrochloric acid, and again precipitated and washed. The almost perfectly pure hydrate so obtained was then finally converted to chloride by solution in hydrochloric acid.

In order to obtain data as to the atomic weight of masrium the following determinations were made. A known quantity of the chloride solution was precipitated by ammonia, and the hydrate thus obtained was ignited, and the remaining oxide weighed. A second portion was precipitated by a solution of microcosmic salt in presence of ammonia, and the phosphate obtained ignited and weighed. The chlorine contained in a third portion was determined by means of silver nitrate in the ordinary manner. From the numbers so obtained the equivalent of masrium was calculated. A pure preparation of masrium oxalate was also obtained by precipitating the neutral solution of the chloride with ammonium oxalate, masrium oxalate resembling the oxalate of calcium in being insoluble under such conditions. The precipitated oxalate was washed, dried, and ignited in a combustion tube whose forward end was filled with copper oxide, when the salt was decomposed with elimination of its water of crystallization, which was absorbed and weighed in the usual manner. The residual oxide was also weighed,

[1] From Nature.

and the oxalic acid, in another quantity of the salt, was determined by means of a standard solution of potassium permanganate. The crystals of the oxalate were thus found to contain 52.70 per cent of masrium oxide, 15.85 per cent of oxalic anhydride, and 31.27 per cent of water.

From the whole of the analytical data yet obtained, assuming, as the reactions of the salts would indicate, that masrium is a divalent element, the atomic weight would appear to be 228. An element of atomic weight about 225 is, indeed, required to occupy a vacant place in the periodic system in the beryllium-calcium group, and masrium appears likely to be the element in question.

Masrium has only yet been observed to combine with oxygen in one proportion, to form the oxide MsO. Masrium oxide is a white substance much resembling the oxides of the lime group. The chloride, $MsCl_2$, is obtained upon evaporation of a solution of the oxide or hydrate in hydrochloric acid. The nitrate, $Ms(NO_3)_2$, crystallizes from 50 per cent alcohol, and the crystals contain water, the amount of which has not been determined. The sulphate, $MsSO_4 . 8H_2O$, is a white salt which crystallizes badly from water, but which separates in well-developed crystals from 50 per cent alcohol. It combines with sulphate of alumina to form an alum, also with potassium sulphate to form a double sulphate. The oxalate above referred to, $MsC_2O_4 . 8H_2O$, is a white salt, soluble in acetic acid, and also in excess of masrium chloride.

The most important reactions of the salts of masrium, as far as they have yet been studied, are the following. Sulphuretted hydrogen produces no precipitate in presence of hydrochloric acid, but yields a white precipitate in presence of acetic acid. Ammonia precipitates the white hydrate of masrium from solutions of the salts; the hydrate is insoluble in excess of ammonia. Ammonium sulphide and carbonate produce white gelatinous precipitates, likewise insoluble in excess of the reagents. Ammonium phosphate yields a white precipitate of phosphate. Caustic alkalies precipitate the hydrate, but the precipitate is readily soluble in excess of the alkaline hydrate. Potassium ferrocyanide produces a white precipitate which is soluble in excess of masrium chloride, but not in dilute hydrochloric acid. Potassium ferricyanide yields no precipitate. Potassium chromate precipitates yellow chromate of masrium, which is soluble in a further quantity of masrium chloride. Potassium tartrate yields a white tartrate precipitate which dissolves in excess of the reagent, but the solution is not reprecipitated by the addition of ammonia.

Metallic masrium has not yet been obtained. Attempts to isolate it by heating the chloride with sodium under a layer of common salt, and by the electrolysis of a solution of the cyanide proved unsuccessful. The chloride, moreover, is not sufficiently volatile to permit of its vapor density being determined.

From the above interesting reactions, however, it will be evident that masrium possesses a strong individuality, although on the whole behaving somewhat like the metals of the alkaline earths and those of the zinc group. Further work will doubtless afford more definite information concerning its nature and properties. A. E. TUTTON

SOME NOTES ON THE VICTORIA NYANZA.

THE following observations on the Victoria Nyanza have been sent to the Royal Geographical Society by Mr. Ernest Gedge, who has spent a considerable time on the lake and in its neighborhood: "The appearance of the lake suggests the formation at some remote period of a vast trough or valley; the western coasts give striking indications of this, especially in Karagwé, where the cliffs come sheer down with deep water close in shore. Inland, behind these, can be noticed a succession of lines of fault, running parallel to one another, forming a series of terraces or steps, which finally culminate in the high grassy plateaus stretching away westwards. There is nothing either on this side or on its southern shores suggesting volcanic action; the geological structure consisting for the most part of gneissic formations and schists, with enormous boulders of porphyritic granite, the latter constituting the most prominent feature on its southern coasts, as well as forming a remarkable island in the lake, known as the "Makoko" or white rocks. On the northern shore outcrops of honey-combed iron stone and lava blocks are to be seen, and this change in the geological structure is accompanied by a corresponding change in the vegetation, from the sterile arid wastes so characteristic of the southern coasts, to rich tropical growth. The main visible sources of the water supply for this great reservoir are the Kagera, Nzoia, and Ngure Darash rivers; and these, though continually discharging a certain amount of water into the lake, are of no great size, except during the rainy season, appearing totally inadequate to maintain the equilibrium of the lake, when we consider the volume of water constantly being carried off by the Nile, as well as the loss that must be caused by evaporation from so large an area. This would lead one to suggest the existence of springs to make up the deficiency. The lake is of great depth in places, and the water fresh and clear, though flat and insipid to drink. Fish are plentiful, being mostly caught with a rod and line, the nearest approach to netting being a screen of grass mats, used as a sieve by the people in Lower Kavirondo, and the basket traps used by the Ba-Sesse. Amongst others is a Silurus, which has evidently been mistaken for the porpoise, owing to its shiny black body, and its habit of coming to the surface and indulging in porpoise-like gambols in calm weather. Hippopotami are not very plentiful, as they chiefly confine themselves to the coasts and rivers. Those that are found in the open water are, however, extremely vicious and much feared by the Ba-Sesse canoe-men, who, strange to say, are unable to swim. This is no doubt largely due to the fact of the lake being infested with alligators, rendering it dangerous for any one to enter the water. Cyclonic storms of great violence occur at certain seasons, and are most dangerous to small craft. These storms in August usually occur at daybreak, coming from the south-west, with much thunder and lightning. Following the coast-line for a time, they would suddenly sweep across the lake in a north-east direction, raising a tremendous sea, and on several occasions we were in imminent danger of being swamped. During this month I noticed that about 3 A.M. the wind was invariably off-shore, varying from the north-north-east to north and north-west. This would drop about 11 A.M., to be followed by a calm lasting to about 2 P.M., when the wind would again come up and blow strongly, in gradually increasing force, from the south-west to south, dying away again at night about 8 P.M. During November the prevailing wind was from the north-east. One of the most remarkable phenomena I witnessed was the apparent tide observable at irregular intervals, the waves coming in and overflowing the beach in exactly the same way as the tide on the sea-shore, the rise and fall lasting from half an hour to an hour or more. This has occurred during a comparative calm on some occasions, whilst on others, though a strong gale has been setting inshore, I have not noticed any difference in the lake's level, so it would seem that this occurrence is not altogether attributable to the wind backing up the water. Another curious feature is the periodical rise and fall which, according to the natives, takes place every twenty-five years, and which is shown by the water marks on the shores. At the time of my visit the lake was between eight and nine feet below high-water mark, and the people told me that certain lands then under cultivation would again be flooded in due season, and that the peninsula on which my camp was pitched would again become an island." Similar changes of level have been noticed, both in Lake Tanganyika and Lake Nyassa, and it is very desirable in the interests of geography as well as the development of the continent that continuous observations should be made, in order to discover what is the real character of these changes.

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.*

On request in advance, one hundred copies of the number containing his communication will be furnished free to any correspondent.

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

The Relative Hardness of Cut Diamonds.

WILL you allow me to add the result of my experience to the testimony of Mr. Kunz that the hardness of diamonds is not perceptibly reduced by cutting and polishing? In the earlier years of my experience in ruling upon glass I was accustomed to select a gem with a smoothly glazed surface, and, splitting the stone in a cleavage plane inclined at a rather sharp angle to the natural face selected, this split face was then ground and polished.

In this way I was able to obtain at several points short knife-edges, which gave superb results in ruling. It was soon found, however that after ruling several thousand rather heavy lines the diamond was liable to lose its sharp cutting-edge, and this experience became so frequent that I was compelled to resort to the method now employed, that of grinding and polishing both faces to a knife-edge I have one ruling diamond prepared in this way, which has been in constant use for four years, and its capacity for good work has not yet been reduced in the slightest degree.

A diamond prepared by Mr. Max Levy of Philadelphia has given even better results, and so far it shows no evidence of wear.

WM. A. ROGERS.

Colby University, Waterville, Me., June 6.

The Notion of Four-Fold Space.

IN a paper by Professor T. Proctor Hall, entitled "The Possibility of a Realization of Four-fold Space," a digest of which appeared in *Science* for May 13, the author, after making certain allusions, remarks "there is therefore nothing inherently absurd or improbable in the supposition that any of us may attain to a concept of four-fold space 'as clear as the designer and the draughtsman have of three-fold space.'" The word "therefore" refers to what immediately precedes, and here we read: "Perhaps most of us can remember times in the course of our education when new conceptions of quantity entered into our conscious life, conceptions which correspond in a general way with those of length, area, and volume, in that they enable us to find at once such relationships as are most frequently required for practical purposes by a general, synthetic, instinctive method . . . . The sense of propriety, the sense of honor, and numberless other 'inbred' or 'instinctive' concepts are examples of this mental tendency." There is no such connection, however, between this and the succeeding paragraph, quoted above, as to justify the assertion made with reference to the conception of four-fold space, and the utmost that can be properly inferred is, that, in the words of the following sentence, "such a conception would be of great value to all classes of scientists"—assuming always that it is a possible conception, that is, possible to us with our present mental constitution. I do not propose to enter into this question, but it seems to me that Professor Hall's argument is open to criticism in other respects

For instance, he does not sufficiently meet the objection based on the fact that "our conception of three-fold space is derived directly from sensations in three-fold space, and that the conception of four-fold space cannot be derived in a similar way, nor yet from sensations in three-fold space." It may be admitted that from the sense of sight we get only a two-dimensional sensation, and that the existence of a third dimension is solely a matter of inference. Yet, this inference has a physiological basis, and is justified by universal experience in past and present generations, so that we know that it expresses the truth. The conditions relative to the conception of four-fold space are quite different. There are apparently no grounds on which a fourth dimension can be inferred, and so far from such an inference being in accordance with experience, this entirely opposes it. To render the truth of such an inference probable, it would have to be shown that the existence of a third dimension is inferred solely from that of two-dimensional space, and yet even then, as the conception of a three-fold dimension would be supported only by that of a two-fold dimension, it would hardly form a sufficient basis for the existence of a fourth. In fact this would ultimately, like the second, be based on the conception of two-fold space.

The conditions of the question are such that the hypothesis of a fourth dimension cannot be made as real to us as that of the existence of a third dimension; any more than Professor Hall's plane being, that is, a being who has no conception of volume, could understand a geometric solid. It is one thing for a person who knows all about three-dimensional space to explain how an imaginary plane being might be able to form such a conception, but a totally different thing for the plane being to perform the operation. The conduct of animals shows that they act according to the same view of space that we do, and yet none of them could form any idea of the relations of the faces of a cube, although propably some very clever dogs can be taught the number of its faces. How much less could any plane being form an idea of those relations. In supposititious cases of this kind, it is always assumed that the imaginary being would be limited only in his ideas of space, but surely this notion is erroneous. A being thus deficient would, by virtue of the law of organic correlation, be equally deficient in other respects, and would rank in an inferior grade of organic development. Such being the case, it is impossible to imagine a plane being acting as a three-dimensional philosopher, and constructing a theory of the evolution of circles, true or false.

It seems to me that those who endeavor to imagine the possibility of four-dimensional space look in the wrong direction. It is very questionable whether, as we are at present constituted, we can possibly form any such idea of space, but there is another view which is worthy of consideration. We know space only in relation to formed matter, and if such matter were to disappear, space would, as so related at least, disappear also. According to present conditions such a state of things would seem to be highly improbable, but we can nevertheless, from what we know of the past, conceive its possibility. If we trace the evolu ional stages of organic nature back through the higher animals from man we reach the worm, from which, according to Hæckel, they have all sprung. Going still further back we come to the primitive moneral ancestor of all organic existence on the earth. But we can retrace the path of evolution beyond the primordial slime, until we arrive at its beginning when, says Professor Crookes, "primitive matter was formed by the act of a generative force, throwing off at intervals of time atoms endowed with varying quantities of primitive forms of energy." Before this there existed, we are told, the formless fluid, from knots and voids in which the chemical elements were formed.

But what has had a beginning can come to an end, and we can imagine therefore all organic and inorganic forms being reduced to the primitive elements, and these elements themselves resolved into the formless fluid from which they were derived. Professor

Crookes says, indeed, "that the atoms are not eternal in existence, but share with all other created beings the attributes of decay and death." They cannot be dissolved into nothing, however, and the only condition they could assume would be that of the formless fluid from which they originally emerged. If this were to happen, matter as we know it would cease to exist, and material or three-dimensional space would with it disappear.

Such a change as is here supposed would be one of pure negation, that is, it would be the negation of all material existence. And yet it would not be absolute negation. It might be described as the absence of position. Every past stage of evolution is negative to that which immediately succeeds it, and yet it is positive to that which has gone before; so that if we go back to the beginning of evolution, the earliest negation is the most real of all existences, because it is that from which all other existence has been derived. Thus formed matter in ceasing to exist as such, and in being resolved again into the primitive formless fluid, would yet continue to exist in a negative state, that is, in its original formless condition, as to the nature of which we can frame no clear idea, beyond that it would be non-material and invisible. Probably we should be justified in considering it the same as the ether.

The existence of the ether is as real as that of formed matter, judging from the phenomena of light, and for that we know there may be ethereal existences which are not subject to the laws which affect that matter. It may be, moreover, that the ether furnishes the link which unites individuals so as to form "genetic or race relationships," and that it conceals the world of spirits, if such exists, from material gaze. The race unity which Professor Hall refers to may, indeed, be conceived of as consistent with, and as even requiring the continued existence of, individuals; just as the existence of a wire depends on that of its constituent molecules. Thus the death of an organism may include a change, unless it be simply a *return*, to a state of immateriality and, therefore, of invisibility. If so. such a negative existence may be the end of all things, material as well as organic; and, since complete change of form often, as in the case of destruction by fire, takes place rapidly, there may be conditions under which, instead of as Professor Hall imagines a plane being stepping. out of our space and re-entering it again, matter may suddenly become invisible, that is, be reduced to a state of formless fluid, and again become visible. Under such a condition, all the phenomena which it is supposed the existence of four-fold space would render possible, could be equally well produced without it. The erratic nature of ghosts even would be explainable on the assumption that ethereal existences have the power, under special circumstances, of making use of the physical forces so as to render themselves visible. This is, however, beside the real question, which is the possibility of a state of relatively negative existence, which, although invisible to us, is as real as that on the material plane. C. STANILAND WAKE,

349 North Clark St., Chicago, June 1.

The Possibility of a Realization of Four-Fold Space.

DR. HALL'S argument for this possibility (*Science*, May 13, 1892) turns upon two other possibilities: first, upon the possibility of building up the conception of this kind of space from that which we already know; and, second, on the possibility of making such a conception so perfect that it may fairly be said to be realized. In support of the first he instances the visual perception of space in which we are supposed to get three fold space by inference from a plane image. Many psychologists, however, contend that such a constructive inference is quite impossible, and others believe that it is only made possible in the case of vision by the aid of touch. Even those that admit a construction of the sort required, can hardly deny that it occurs in the very beginning of babyhood, a fact that points to a racial rather than an individual acquisition. It appears, therefore, to be extremely doubtful whether Dr. Hall could get a four-fold space conception built up in a single generation, if at all; that is, if it is to be realized in anything like the degree in which we realize three-fold space.

If, however, by realization is meant only a tolerably complete knowledge about four-fold space,— such, for example, as a deaf physicist could get of sound,— it may be possible to realize it; and Dr. Hall has undoubtedly taken the right road. But knowledge about a thing seems to come somewhat short of realization of it. Some sensory element is also required, and especially verification by touch, which is the sense of last appeal in cases of doubtful reality. Dr. Hall's models would appear to this sense as unquestionably three-fold as a perspective drawing would appear plane.

In regard to the benefits of a full knowledge of four-fold space, Dr. Hall should not allow himself to hope too much. A really clever and elusive ghost would never stop at four-dimensions, but would surely lead him, Will o'-the-wisp fashion, through all the series of n dimensions. EDMUND C. SANFORD.

Clark University, Worcester, Mass., June 6.

Eskimo Throwing-Sticks.

IN my pamphlet on the Eskimo Throwing-Sticks I drew attention to the fact that they are all right-handed save two from the Alaskan Peninsula and that neighborhood. I also mentioned two specimens afterwards described by Ensign Niblack from the T'lingit area in south-eastern Alaska. I neglected to mention that they are ambidextrous, and so is a beautiful specimen from the Vancouver collection, figured by Mr. Charles H. Read in the *Journal of the Anthropological Institute* (Vol. XXI., pl. xi.), bilaterally symmetrical and, doubtless, ambidextrous. In British Columbia and Washington the long-handled fish-spear is ambidextrous, and has two finger-notches on the end, answering to, if not derived from, the form further south. Mr. Read's specimen from Santa Barbara, Cal., is an abbreviated specimen of like form to one lately recovered from Lake Patzcuaro, Mex., by Captain John G. Bourke, U.S.A., suitable for either hand. Looking over the interesting pamphlets of Mrs. Nuttall and Messieurs Stolpe, Uhle, Bahnson, Seler, and de Mortellet, I find most of the spear-throwers or throwing-sticks adapted to either hand. The ornamentation throws a considerable amount of uncertainty over the elaborate forms, but, omitting the Eskimo examples, all other spear-throwers appear to be ambidextrous. Indeed, I should like to inquire whether outside of the Eskimo area any American aborigines had apparatus that would not fit either hand.

Hasty conclusions are dangerous, but we may be allowed to say that the development of a purely right handed implement points to a southern origin for the original invention. At any rate, the atlatl is assuming an enviable importance in comparative technography. While upon the subject I should like to draw attention to the Mexican artist's fashion of pulling certain parts of a solid body into the foreground, as in the heart-shaped finger-pocket or grip on the bottom of the atlatl, always exhibited on the side. Notice is also called to the fashion of shortening objects to get them into a picture; for example, in many cases a harpoon with a shaft ten feet long is represented with all its parts in as many inches. O. T. MASON.

Washington, D.C., June 7.

AMONG THE PUBLISHERS.

THE Scientific Publishing Company, 27 Park Place, New York, have in press Dr. Endlich's "Manual of Qualitative Blowpipe Analysis."

— William R. Jenkins, New York, has just issued "Parasites and Parasitic Diseases of the Domesticated Animals," by L. G. Neumann, professor at the National Veterinary School of Toulouse, translated and edited by George Fleming.

— Harper & Brothers have nearly ready a book which doubtless will provoke no little discussion and controversy. In is entitled "The Puritan in Holland, England, and America," by Douglas Campbell, who claims that the last word regarding the Puritan settlers of New England has not yet been written, and that many of the prevalent ideas concerning the earlier influences upon the political, social, and religious life of the American people are susceptible of revision.

— Charles Scribner's Sons will publish shortly a book on Norse history, industries, literature, and social life, etc., entitled "Norway and the Norwegians," by C. F. Keary, an authority on the land of the Vikings; an important and entertaining volume, entitled "Conversations and Correspondence with Thomas Carlyle," by Sir Charles G. Duffy; "Principles of Theoretical and Practical Logic," by Professor J. H. Hyslop of Columbia; and a book called "First Aid in Illness and Injury" (written and illustrated by Captain James E. Pilcher, U.S.A.), the purpose of which is to supply instructions that anyone can understand. for the emergencies and accidents that the human machine is liable to.

— *Babyhood* contains in its June issue an article on "Infantile Grief," in which the writer, Dr. J. M. W. Kitchen, relates the results of his investigations into a baby's cry. Dr. D. Warman speaks of the heart affections of children due to over-exertion, and describes several striking cases in which the heart was affected by rope-jumping and sudden fright. Other medical topics are discussed. The mothers themselves write in the "Parliament" about the best way of putting children to sleep, about the careful and the careless way of training the little ones, about purity in the bath, and many other things of interest.

— Houghton, Mifflin, & Co. will publish this month Walter Crane's new book, "The Claims of Decorative Art," papers on "The Structure and Evolution of Decorative Pattern," "Art and Labor," "The Position and Claims of Decorative Art," "Art and Handicraft," "Importance of the Applied Arts and Their Relations to Common Life," and other subjects, illustrated by the author; "Favorite Flies and Their Histories: with replies from experienced anglers to inquiries concerning how, when, and where to use them," by Mary E. Orvis Marbury, with numerous illustrations; the fourth volume of Charles S. Sargent's important work on "The Silva of North America;" "Phases of Thought and Criticism," by Brother Azarias, who has won an enviable reputation for his scholarship and for his clear and attractive style; and the fourth edition, revised, of Edward Stanwood's "History of Presidential Elections."

— Fritz von Szczepanski, the author of the valuable "Bibliotheca Polytechnica" published last year, has just issued a "Bibliotheca Electrotechnica," being a classified and descriptive guide to electrical books published in English, German, and French. The catalogue is divided into thirty-one departments under the following headings: Journals and Annuals; Theory of Electricity and Magnetism; History of Electricity; Electricity in Exhibitions; Batteries and Storage Batteries; Electric Lighting; Electricity in Mining; Bibliography; Lightning Conductors; Electricity in Railways; Military Electricity; Legal Aspect of Electricity; Electro-Chemistry; Electromotors; Galvanoplasty; Electric Bells; Domestic Electricity; Instruments; Electric Transmission of Energy; Conduits; Electric Machines; Measurements; Potential; Statical Electricity; Tables and Formulæ; Telegraphy; Transformers; and Electric Clock Making. The catalogue is a reasonably complete list of modern electrotechnical literature issued since 1883, with data of size, price, and name of publisher, and a full author-index. Published in New York by the International News Company.

— Messrs. Houghton, Mifflin, & Co. have published a work by the Rev. Lyman Abbott entitled "The Evolution of Christianity." Mr. Abbott is enamored of the doctrine of evolution, and, seeing its inconsistency with many things in Christianity, he has endeavored in this volume to give a new interpretation to some of the older doctrines, so as to bring his religion into harmony with the new philosophy. He is not the first to make such an attempt, but we cannot think that he has had much better success than those who have tried the same task before him. He quotes Professor LeConte's definition of evolution as "continuous progressive change, according to certain laws, and by means of resident forces;" he defines religion as "the life of God in the soul of man;" and then endeavors to show that "the Christian religion is itself an evolution." To a certain extent, of course, he has no difficulty in so doing, though we cannot think he has always sketched the development of Christianity correctly. But he insists that Jesus was an exception to the universal law — that he was in no sense a product of evolution. The principal defect of Mr. Abbott's work, however, is its vagueness in matters of doctrine. He avoids the discussion of doctrines as far as he can, and whenever he alludes to them, he leaves us in doubt as to what his real opinion is. We cannot make out even what he thinks about God, his views on the subject of Deity being a compound of Christian theism and German pantheism, with the latter element, it seems to us, predominating. Mr. Abbott's book will suit those whose religion is sentimental rather than intellectual and practical, and will doubtless please the partisans of evolutionism; but it does not even touch the deeper religious problems of the age, and consequently contributes nothing toward the religion of the future.

— During the past year the editor of "Appleton's General Guide" has made a trip over the entire United States and Canada. The information gathered by him has been incorporated in the present edition. Among the new features will be found: 1. Descriptions of routes, resulting from increased railroad facilities. 2. Descriptions of resorts, notably those on the Pacific Coast. 3. The leading cities have all been visited, and the latest information concerning each has been gathered for this work by some special expert. 4. Itineraries of each of the larger cities will be found at the proper places, describing how the salient features may be seen in the shortest space of time possible. 5. New plans and new maps of the environs of the cities have been specially prepared for this edition. 6. The old illustrations give place to new ones procured especially for the present edition. Each year finds an increasing numer of our citizens who desire to know more about their own country, and each year brings an increasing influx of foreign tourists who desire to see those features which are most significantly American. For both of these classes this book is designed.

— Portraits of seventeen American anthropologists will accompany Prof. Frederick Starr's article on "Anthropological Work in America," which is to open *The Popular Science Monthly* for July. The article shows that both in quality and amount the work of Americans in this field compares favorably with that of Europeans, described by Professor Starr in an earlier number. The fifteenth article in the series on the Development of American Industries since Columbus will be published in the July number. It is on "Leather-making," and, like all in the series, it is fully illustrated. The author is Mr. George A. Rich, of the Boston *Journal*. There are illustrated articles on "New England Owls" and certain "Rare Monkeys." A stimulating article on present educational problems will be by Mrs. H. M. Plunkett. It is entitled 'Kindergartens—Manual Training—Industrial Schools," and embodies some principles of training children that have not yet been duly appreciated.

— W. J. Johnston Co., Ltd., New York, have just issued the second edition of Professor E. J. Houston's "Dictionary of Electrical Words, Terms, and Phrases." The first edition of this work was published in 1889, and was the first book which defined and explained electrical terms in such language as could readily be understood by the general public. The second edition is almost entirely rewritten, and is fully twice the size of the first edition. It contains not far from 5,000 distinct titles under which definitions and explanatory matter are given, and nearly as many more titles under which cross-references occur. The treatment of each title includes — first, a brief definition in large type; and, second, explanatory and descriptive matter in smaller type for the benefit of those who wish fuller information than would be given in an ordinary definition. The text is amply illustrated by 570 figures of electrical apparatus The book is one which cannot fail to be of value to the professional man generally, and also to the intelligent reader of scientific periodicals, as well as of the newspapers and magazines.

— We have received from the J. B. Lippincott Co. "The Proceedings of the first annual Meeting of the National Conference on University Extension," held in Philadelphia last December. The object of the meeting was to discuss the methods appropriate to university extension work and to devise plans for the more efficient conduct of the work hereafter; and the exercises consisted partly of reports of the work already done or in progress in the different parts of the country, and partly of addresses on various topics connected with the subject. Among the reports that of Mr. Henderson, the general secretary, and that of Mr. Dewey on the extension movement in New York State are the most important; while of the addresses we may mention particularly those of William T. Harris on "The Place of University Extension in American Education;" of Michael E. Sadler, of Oxford, on "The Development of University Extension in England;" and of Edmund J. James, the president of the association, on "The University Extension Lecturer." Considerable enthusiasm was manifested among the members present; yet it is plain from what was said that the movement has not yet produced anything approaching the beneficial results of the corresponding movement in England. More than one speaker explicitly stated that hitherto the extension lectures had been chiefly attended by cultured persons, and that "thus far the effort to reach that great portion of the people whose opportunities for education and mental culture have been limited, has failed." This fact, together with the superficiality which is inherent in such a method of teaching, are serious drawbacks; yet if the new movement can accomplish half that its enthusiastic promoters anticipate, we heartily wish it success.

— The ethnography and ethnology of Tierra del Fuego is the subject of the seventh volume, noticed in the *Scottish Geographical Magazine* for May, of the reports on the French Expedition which in 1882, observed the Transit of Venus. The Onas inhabit the eastern part of the main island; the Alakaluf dwell on the smaller islands on the north-western side of the Archipelago; and the Yaghans, allied physically and anthropologically to the Alakaluf, are found among the southern islands. They are far more numerous than the other tribes, and, as the French station was established in their district, the anthropological observations principally relate to them. The average height of the men is 5 feet 2 inches, and of the women 4 feet 10 inches. The skull is large, comparatively high, and of medium breadth. The face is long and angular, with a narrow, low, and receding forehead. The eyes are small and brown in color, the nose concave with wide nostrils, the mouth broad and the lips thick, and the cheek bones prominent. The upper extremities are proportionally long, and the lower short. The hair is black, straight, and stiff. The skin is yellow, brownish or reddish. The Yaghans are decidedly different in type from the neighboring South American races, and resemble in their corporal peculiarities certain scattered tribes of the centre and north of South America — the Guarani, Coroado, the Aimara of Peru, and, above all, the Botocudo. They are probably remnants of an early sub brachycephalous race who were scattered by the invasion of the later brachycephalous tribes.

— One of the early issues of D. C. Heath & Co. will be a little volume for primary schools called "Leaves and Flowers," by

CALENDAR OF SOCIETIES.

Appalachian Mountain Club, Boston.

June 8. — E. H. Russell, Camping Out; Thomas Crozier, The Grafton Camp.

Biological Society, Washington.

May 28. — Theodore Gill, On the Super-Family Chætodontoidea; C. Hart Merriam, The Plants of the Pribilof Islands, Coon Cave, Missouri; Frederick V. Coville, Uses of Plants Among the Panamint Indians.

Publications Received at Editor's Office.

NATIONAL CONFERENCE ON UNIVERSITY EXTENSION. Proceedings of the first annual meeting, Phila., J. B. Lippincott Co. 8°. 292 p. $1.50.

PILLING, JAMES C. Bibliography of the Algonquian Languages. Washington, Government. 8°. 624 p.

ROMANES, GEORGE J. Darwin and after Darwin. I. The Darwinian Theory. Chicago, Open Court Pub. Co. 12°. 460 p. $2.

SCHWAB, JOHN C. AND OTHERS. The Yale Review. Vol. I., No. 1, May, 1892. Boston, Ginn & Co. 8°, paper. 112 p. 75 cts.

UNIVERSITY OF WISCONSIN. Eighth Annual Report of the Agricultural Experiment Station, for the year ending June, 1891. Madison, State Printers. 8°. 326 p.

U. S. GEOLOGICAL SURVEY. Contributions to North American Ethnology. Vol. VI. Washington, Government. 4°. 812 p.

WHITNEY, HENRY M. Tourists' Guide through the Hawaiian Islands. Honolulu, Hawaiian Gazette Co. 8°. 176 p. 60 cts.

WRIGHT, JULIA MCNAIR. Nature Readers. No. 4 Sea-side and Way-side. Boston, D. C. Heath & Co. 12°. 370 p. Ill. 70 cts.

Exchanges.

[Free of charge to all, if of satisfactory character. Address N. D. C. Hodges, 874 Broadway, New York.]

Taxidermist going out of business has quantity of finely-mounted specimens of North American birds, mammals and reptiles and skins of birds for sale, including a full local collection of bird skins, showing some great variations of species; also quantity of skulls with horns of deer and mountain sheep, and mounted heads of same. Will give good exchange for Hawk Eye camera with outfit. Apply quickly to J. R. Thurston, 265 Yonge St., Toronto, Canada.

For exchange.—A fine thirteen-keyed flute in leather covered case, for a photograph camera suitable for making lantern slides. Flute cost $27, and is nearly new. U. O. COX, Mankato, Minn.

To exchange; Experiment Station bulletins and reports for bulletins and reports not in my file. I will send list of what I have for exchange. P. H. ROLFS, Lake City, Florida.

Finished specimens of all colors of Vermont marble for fine fossils or crystals. Will be given only for valuable specimens because of the cost of polishing. GEO. W. PERRY, State Geologist, Rutland, Vt.

For exchange.—Three copies of "American State Papers Bearing on Sunday Legislation," 1891, $2.50, new and unused, for "The Sabbath," by Harmon Kingsbury, 1840; "The Sabbath," by A. A. Phelps, 1842; "History of the Institution of the Sabbath Day, Its Uses and Abuses," by W. L. Fisher, 1859; "Humorous Phases of the Law,' by Irving Browne; or other works amounting to value of books exchanged, on the question of governmental legislation in reference to religion, personal liberty, etc. If preferred, I will sell "American State Papers," and buy other books on the subject. WILLIAM ADDISON BLAKELY, Chicago, Ill.

For Sale or Exchange for books a complete private chemical laboratory outfit. Includes large Becker balance (200g. to 1-10mg.), platinum dishes and crucibles, agate motors, glass-blowing apparatus, etc. For sale in part or whole. Also complete file of *Silliman's Journal*, 1862-1885 (62-71 bound); Smithsonian Reports, 1854-1883; U. S. Coast Survey, 1854-1869. Full particulars to enquirers. F. GARDINER, JR., Pomfret, Conn.

Wanted, in exchange for the following works, any standard works on Surgery and on Diseases of Children: Wilson's "American Ornithology," 3 vols.; Coues' "Birds of the Northwest" and "Birds of the Colorado Valley," 2 vols.; Minot's "Land and Game Birds of New England;" Samuels' "Our Northern and Eastern Birds;" all the Reports on the Birds of the Pacific R. R. Survey, bound in 2 vols., morocco; and a complete set of the Reports of the Arkansas Geological Survey. Please give editions and dates in corresponding. R. ELLSWORTH CALL, High School, Des Moines, Iowa.

To exchange Wright's "Ice Age in North America" and Le Conte's "Elements of Geology" (Copyright 1882) for "Darwinism," by A. R. Wallace, "Origin of Species," by Darwin, "Descent of Man," by Darwin, "Man's Place in Nature," Huxley, "Mental Evolution in Animals," by Romanes, "Pre-Adamites," by Winchell. No books wanted except latest editions, and books in good condition. C. S. Brown, Jr., Vanderbilt University, Nashville, Tenn.

Wants.

Any person seeking a position for which he is qualified by his scientific attainments, or any person seeking some one to fill a position of this character, be it that of a teacher of science, chemist, draughtsman, or what not, may have the 'Want' inserted under this head FREE OF COST, *if he satisfies the publisher of the suitable character of his application. Any person seeking information on any scientific question, the address of any scientific man, or who can in any way use this column for a purpose consonant with the nature of the paper, is cordially invited to do so.*

WANTED.—We want any and all of the following, providing we can trade other books and magazines or buy them cheap for cash: Academy, London, vol. 1 to 28, 35, Jan. and Feb., '89; Age of Steel, vol. 1 to 66; American Antiquarian, vol. 1, 2; American Architect, vol. 1 to 6, 9; American Art Review, vol. 3; American Field, vol. 1 to 21; American Geologist, vol. 1 to 6; American Machinist, vol. 1 to 4; Art Amateur, vol. 1 to 7, Oct., '4; Art Interchange, vol. 1 to 9; Art Union, vol. 1 to 4, Jan., '44, July, '45; Bibliotheca Sacra, vol. 1 to 46; Godey's Lady's Book, vol. 1 to 20; New Englander, vol. 11; Zoologist, Series 1 and 1, Series 3 vol. 1 to 14; Allen Armendale (a novel). Raymer's "Old Book" Store, 243 4th Ave. S., Minneapolis, Minn.

WANTED.—By a young man, a Swarthmore College junior, a position as principal of a public high school in one of the Gulf States, or as instructor in botany, physiology, and geology in an academy or normal school. Address B., care of Librarian, Swarthmore College, Penn.

WANTED.—A teacher of Geology who is familiar with the fossils of the Hamilton Group, as instructor of Geology during July next at the Natural Science Camp on Canandaigua lake. Apply to ALBERT L. AREY, Director, 229 Averill Ave., Rochester, N. Y.

WANTED.—To act as correspondent for one or two daily or weekly papers. Have worked on paper for about two years Would like a position on editorial staff of humorous paper. Address GEO. C. MASON, 14 Elm St., Hartford, Conn.

TRANSLATOR wanted to read German architectural works at sight (no writing). One familiar with technical terms desired. Address "A.," Box 149, New York Post Office.

WANTED.—A position in a manufacturing establishment by a manufacturing Chemist of inventive ability. Address M. W. B , care of *Science*, 874 Broadway, N. Y.

WANTED.—Books on Anatomy and Hypnotism. Will pay cash or give similar books in exchange. Also want medical battery and photo outfit. DR. ANDERSON, 182 State street, Chicago, Ill.

WANTED.—A college graduate with some normal training, to teach the sciences, at $1,800 per year, in a Southern college. A Baptist or a Methodist preferred. Must also be a first-class Latin scholar. A. H. Beals, Box K, Milledgeville, Ga.

ADDRESS WANTED.—Will some one please send the address of the Secretary of the American Philological Society. Also that of Herbert Spencer. "ADDISON," Room 84, 164 Madison St., Chicago, Ill.

Mary A. Spear, late principal of the Model School of West Chester (Pa.) State Normal School. These plant studies combine drill in reading with sound botanical information, calculated to serve as a useful basis to later study. At the same time care is taken that the information shall be obtained by actual observation of leaves, stems, and flowers. A feature of this book is its arrangement, which enables it to be taken up in the autumn, if the study cannot be begun in the spring.

— *Neptunia*, January, 1892, contains a map showing the distribution of Plankton, in the North Atlantic, as far as it was ascertained by the expedition of the Humboldt Stiftung. In an accompanying paper, Herr F. Schütt discusses the result of the expedition.

— We learn from the *Scottish Geographical Magazine* that two handbooks of professional instructions for the trigonometrical and topographical branches of the Indian Survey Department have just been issued from the office of the former at Dehra Dun, in the North-West Provinces. They have been prepared by Colonel G. Stahan, R.E., under the direction of Colonel H. R. Thuillier, R.E., the Surveyor-General, and will prove most useful to the numerous officers of that department, as well as to students and others in this country who contemplate joining the service. Some of the miscellaneous chapters, such as those on the care and treatment of elephants and on the health and management of a party, will be found to have a good deal of interest for the general reader, while the more purely technical parts contain full and instructive information as to the important and miscellaneous scientific tasks which fall to the lot of the Indian surveyor.

— Bret Harte's young daughter, Miss Jessamy Harte, will make her literary début in the July *Ladies' Home Journal* with a most entertaining description of "Camp Life in the Adirondacks," in which it is claimed every evidence shows itself of inherited literary tendencies not unlike those evidenced in Bret Harte's earlier work. Miss Harte is a girl still in her teens and has artistic as well as literary proclivities, as one of the illustrations accompanying her first article shows.

TO THE READERS OF SCIENCE.

PUBLISHER'S ANNOUNCEMENT.

OUR PLANS.

WITHIN the past six months the use of *Science* by scientific men and women as a medium for prompt publication and weekly discussion, has increased very materially, so that the pages are now well filled each week with original matter. As the number of those promising contributions is increasing at the rate of three or four each day, it cannot be long before *Science* at its present size will be too small for the amount of matter offered. We have under consideration therefore an enlargement of the paper by one-half, but must first learn the temper of our constituency as to an advance in price to $5.00, which was the subscription price from the start for four years, up to June 30, 1887. Further, to carry out the proposed enlargement, we shall need five hundred additional subscribers. If you are not already a subscriber, are you willing to aid in making *Science* more worthy of American scientific work by becoming one?

It goes without saying, that the demand for scientific literature is limited, when compared with that for literature which is more to the public taste, so that the receipts of most of the Scientific Journals, in this country, do not pay quite for their printing and paper, to say nothing of the other items of expense. We say this merely to emphasize the fact, that generous and prompt support must be accorded this move if it is to succeed.

Titles of Some Articles Published in *Science* since Jan. 1, 1892.

Aboriginal North American Tea.
Actinism.
Amenhotep, King, the tomb of.
Anthropology, Current Notes on.
Arsenical Poisoning from Domestic Fabrics.
Anatomy, The Teaching of, to Advanced Medical Students.
Astronomical Notes.
Botanical Laboratory, A.
Brain, A Few Characteristics of the Avian.
Celts, The Question of the.
Collection of Objects Used in Worship.
Deaf, Higher Education of the.
Diphtheria, Tox-Albumin.
Etymology of two Iroquoian Compound Stems.
Eye-Habits.
Family Traits, Persistency of.
Fishes, The Distribution of.
Fossils, Notice of New Gigantic.
Grasses, Homoptera Injurious to.
"Healing, Divine."
Hemipterous Mouth, Structure of the.
Hypnotism among the Lower Animals.
Hypnotism, Traumatic.
Indian occupation of New York.
Influenza, Latest Details Concerning the Germs of.
Infant's Movements.
Inventors and Manufacturers, the American Association of.
Iowa Academy of Sciences.
Jargon, The Chinook.
Klamath Nation, Linguistics.
Lightning, The New Method of Protecting Buildings from.
Lissajou's Curves, Simple Apparatus for the Production of.
Maize Plant, Observations on the Growth and Chemical Composition of.
Mineral Discoveries, Some Recent, in the State of Washington.
Museums, The Support of.
Patent Office Building, The.
Pocket Gopher, Attempted Extermination of.
Psychological Laboratory in the University of Toronto.
Psychological Training, The Need of.
Rain-Making.
Rivers, Evolution of the Loup, in Nebraska.
Scientific Alliance, The.
Star, The New, in Auriga.
Storage of Storm-Waters on the Great Plains.
Teaching of Science.
Tiger, A New Sabre-Toothed, from Kansas.
Timber Trees of West Virginia.
Trachea of Insects, Structure of.
Vein-Formation, Valuable Experiments in.
Will, a Recent Analysis of.
Wind-Storms and Trees.
Wines, The Sophisticated French.
Zoology in the Public Schools of Washington, D. C.

Some of the Contributors to *Science* Since Jan. 1, 1892.

Aaron, Eugene M., Philadelphia, Pa.
Allen, Harrison, Philadelphia, Pa.
Baldwin, J. Mark, University of Toronto, Canada.
Barnes, Charles Reid, Madison, Wis.
Baur, G., Clark University, Worcester, Mass.
Beal, W. J., Agricultural College, Mich.
Beals, A. H., Milledgeville, Ga.
Beauchamp, W. M., Baldwinsville, N.Y.
Boas, Franz, Clark University, Worcester, Mass.
Bostwick, Arthur E., Montclair, N J.
Bradley, Milton, Springfield, Mass.
Brinton, D. G., Philadelphia, Pa.
Chandler, H., Buffalo, N.Y.
Comstock, Theo. B., Tucson, Arizona.
Cragin, F. W., Colorado Springs, Col.
Davis, W. M., Harvard College, Cambridge, Mass.
Dimmock, George, Canobie Lake, N.H.
Farrington, E. H., Agricultural Station, Champaign, Ill.
Ferree, Barr, New York City.
Flexner, Simon, Johns Hopkins University, Baltimore, Md.
Foshay, P. Max, Rochester, N.Y.
Gallaudet, E. M., Kendall Green, Washington, D.C.
Garman, S., Museum of Comp. Zool., Cambridge, Mass.
Golden, Katherine E., Agricultural College, Lafayette, Ind.
Hale, Edwin M., Chicago, Ill.
Hale, George S., Boston, Mass.
Hale, Horatio, Clinton, Ontario, Canada.
Hall, T. Proctor, Clark University, Worcester, Mass.
Halsted, Byron D., Rutgers College, New Brunswick, N.J.
Haworth, Erasmus, Oskaloosa, Iowa.
Hay, O. P., Irvington, Ind.
Haynes, Henry W., Boston Mass.
Hazen, H. A., Weather Bureau, Washington, D.C.
Hewitt, J. N. B., Bureau of Ethnology, Washington, D.C.
Hicks, L. E., Lincoln, Neb.
Hill, E. J., Chicago, Ill.
Hill, Geo. A., Naval Observatory, Washington, D.C.
Hitchcock, Romyn, Washington, D.C.
Hotchkiss, Jed., Staunton, Va.
Howe, Jas. Lewis, Louisville, Ky.
Hubbard, Gardiner G., Washington, D.C.
James, Joseph F., Agricultural Dept., Washington, D.C.
Johnson, Roger B., Miami University, Oxford, O.
Kellerman, Mrs. W. A., Columbus, O.
Kellicott, D. S., State University, Columbus, O.
Macloskie, G., Princeton, N.J.
McCarthy, Gerald, Agricultural Station, Raleigh, N.C.
MacDonald, Arthur, Washington, D.C.
Marshall, D. T., Metuchen, N.J.
Mason, O. T., Smithsonian Institution, Washington, D.C.
Nichols, C. F., Boston, Mass.
Nuttall, George H. F., Johns Hopkins University, Baltimore, Md.
Oliver, J. E., Cornell University, Ithaca, N.Y.
Osborn, Henry F., Columbia College, New York City.
Osborn, Herbert, Agricultural College, Ames, Iowa.
Pammel, L. H., Agricultural Station, Ames, Iowa.
Pillsbury, J. H., Smith College, Northampton, Mass.
Ruffner, W. H., Lexington, Va.
Schufeldt, R. W., Washington, D.C.
Scripture, E. W., Clark University, Worcester, Mass.
Slade, D. D., Museum Comp. Zool., Cambridge, Mass.
Smith, John B., Rutgers College, New Brunswick, N.J.
Stevenson, S. Y., Philadelphia, Pa.
Stone, G. H., Colorado Springs, Col.
Thurston, R. H., Cornell University, Ithaca, N.Y.
Todd, J. E., Tabor, Iowa.
True, Frederick W., National Museum, Washington, D.C.
Turner, C. H., University of Cincinnati, Cincinnati, O.
Ward, R. DeC., Harvard University, Cambridge, Mass.
Ward, Stanley M., Scranton, Pa.
Warder, Robert B., Howard University, Washington, D.C.
Welch, Wm. H., Johns Hopkins University, Baltimore, M.D.
West, Gerald M., Clark University, Worcester, Mass.
Williams, Edward H., Lehigh University, Bethlehem, Pa.

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SCIENCE

NEW YORK, JUNE 17, 1892.

INSECTS IN POPULAR DREAD IN NEW MEXICO.

BY C. H. TYLER TOWNSEND.

IN the south-western portion of the United States there are many insects (using the term in its popular sense, and including Arachnida and Myriopoda) which are more or less striking in appearance. The Mexican element, which largely predominates, is wont to clothe many of these forms in superstition and fear. Some of them are more or less poisonous, while others are perfectly harmless. The malignant nature of the poisonous ones is, as a rule, greatly magnified. Space would forbid the detailing in this article of all the species which are held in dread by the Mexicans, and therefore only the most prominent ones will be noticed. It should also be mentioned that many Americans who have lived here for some length of time share to a large extent the fears of the Mexicans in this regard.

The centipedes (*Scolopendra sp.*) in southern New Mexico do not, as a rule, attain a length of more than four or five inches. Some are found at times which measure nearly six inches, but these are exceptional. They are often found in the adobe houses, the roofs of which are thatched and covered with earth. The summer rains disturb them, and they make their appearance inside. No one can be blamed for refusing to pick up a large centipede, yet they are not so dangerous as commonly supposed. As a general rule, a little ammonia applied to the stings will allay all irritation in a few hours, and no swelling will occur. With some persons the effects are more serious. At some future time a paper will be published by the writer, describing cases of bites and stings of this and other poisonous insects.

The whip-scorpion (*Thelyphonus sp.*) occurs here rather sparingly, but attains a good size. It is certainly a formidable looking beast when full grown. The Mexicans call it *viñagron*, and believe, so I am told, that its bite is sure death. A centipede is no comparison to it in the eyes of a Mexican, who would as soon face a rattlesnake or a Gila monster. I have been unable as yet to find anyone here who has been bitten by this insect, and the only specimens I have were brought to me dead. Some authors declare it to be harmless, while others assert the contrary. I believe, however, that a bite from the jaws is more or less poisonous. During a recent excavation in the city of El Paso, Texas, a gang of Mexican laborers was panic-stricken on the appearance, in the hole beside them, of a *viñagron* which had been disclosed by a stroke of the shovel.

The scorpion which occurs here is the smaller light-colored one (*Buthus sp.*), which does not attain a length of much more than two inches, and is usually smaller. It is dreaded by the Mexicans, but the sting is not more severe than that of a hornet, and often causes no swelling and but little irritation, which passes away in a short time.

One of the *Solpugidœ* (probably *Datemes sp.*) occurs here. This family is closely related to the scorpions, and contains some very strange-looking forms. The species in question attains a length of about one and three-quarters inches. The head consists very largely of two massive pairs of jaws, side by side, the two jaws of one pair working vertically on each other instead of horizontally. The pair on one side can work independently of that on the other, and this intensifies the strange appearance of the insect. These are held in great dread, and are doubtless in a certain degree poisonous.

The so-called tarantula (*Lycosa sp.*) comes next, and is undoubtedly the most venomous arthropod we have in this region. It is usually considered deadly. Its bite is attended with serious consequences, if we can believe reports which appear to be well authenticated. The largest specimen I have seen here measures two and one-half inches in the length of its body, which is as large as that of a half-grown mouse.

A huge unshapely cricket (*Stenopelmatus sp.*) is called *miño de la tierra* (child of the earth) by the Mexicans here, for the reason that it occurs in the ground and is supposed to resemble an infant in the form of its head and body. Its bite is believed to be fatal, and the writer once excited the admiration of all present by offering in public to handle all specimens that were brought him. The jaws are large and powerful, and doubtless can bite quite severely, but there is nothing of a poisonous nature connected with the bite. The Mexicans also have a superstition that the *Stenopelmatus* enters the uterus of pregnant females and causes monstrosities. Perhaps the dread of this cricket has arisen from the fact that in general appearance it greatly resembles the solpugid mentioned above.

The rear-horse (*Mantis sp.*) and walking-sticks (*Phasmidœ*) appear to be confounded by the Mexicans, and "old-timers" as well, under the name of *campamoches*. It is one of the most firmly grounded ideas in the mind of the average New Mexico resident, that these insects, when accidentally swallowed by horses or cattle, are sure death to the swallower. No idea apparently could be more absurd, and none is harder to dissipate. I have been told repeatedly of cases where the animal was immediately cut open, and in no case did the operator fail to find a *campamoche* in the stomach. Such positive declarations would almost incline one to the belief that some poisonous properties were resident in the bodies of these insects.

Agricultural College, Las Cruces, New Mexico, June 5.

SCIENTIFIC WORK IN CANADA, AT THE ELEVENTH ANNUAL MEETING OF THE ROYAL SOCIETY OF CANADA, MAY 30 TO JUNE 2.

FIFTEEN papers were read by fellows of the Royal Society of Canada at its last meeting, just closed, in the Section (IV.) of Geology and Biology, and five more in the Department of Chemistry and Physical Sciences (Section III.).

Of the latter, Professor Chapman's paper "On a New Form of Application Goniometer" is of interest to geologists and mineralogists, as is also his additional note "On the Mexican Type in the Crystallization of the Topaz, with some Remarks on Crystallographic Notation."

Then comes Professor J. G. MacGregor's address on "The Fundamental Principles of Abstract Dynamics." Here the independence of Newton's three Laws of Motion is first considered, and an attempt is made to establish it; Maxwell's deduction of the first from the "doctrine of space and time" and Newton's supposed deduction of the third from the first being subjected to criticism. Their sufficiency is then discussed. It is shown that Newton's second interpretation of the third law cannot be regarded either as an enunciation of the law of the conservation of energy or as an hypothesis from which that law may be deduced, and a fourth law is suggested, admitting of this deduction. It is then pointed out that, owing to the essential relativity of acceleration, the laws of motion can hold only by reference to certain points. These points are determined, and more precise enunciations both of the laws of motion and of all deductions from them are thus obtained. Finally, it is shown that the fundamental hypotheses from which all the laws of abstract dynamics can be deduced, may be reduced to two.

Geology and Palæontology come in for seven papers, as follows: Presidential Address, by Mr. G. F. Matthew of St. John, N.B., "On the Diffusion and Sequence of the Cambrian Faunas." In this address an attempt is made to distinguish the littoral and warm-water faunas of the Cambrian age from those which mark greater depths of the sea and cooler water. On the hypothesis that species capable of propagating their kind in the open sea would spread rapidly to all latitudes where the temperature of the sea was favorable, such forms as the graptolites are taken as fixed points in the successive faunas. The relation to the graptolites is noted of various species of other groups of animals, as they occur in different countries. It thus appears that several genera appeared first in America and afterwards spread to Europe. On the other hand, a very close connection appears to have existed between the Cambrian faunas of the north of Europe and those of the Atlantic coast of North America. Hence it is inferred that the temperature of the sea of these two coasts was similar, and the connection between them direct and unimpeded. Equal temperatures in these different latitudes would be maintained by a cold current flowing from the North European to the North Atlantic Coast. The evidence available seems to point to a migration of the American species by a route to the west and north of the main part of the Atlantic Basin.

Mr. Matthew contributed an additional paper, entitled "Illustrations of the Fauna of the St. John Group, No. VII." This is the final paper on this subject, and treats chiefly of the fauna of the highest horizon in the group. It will be accompanied by a list of all the species of the St. John group, showing the several horizons at which they have been found. From the highest horizon itself, the species are of the age of those of the Leirs shale, or thereabout, as shown by the graptolites found here. There are several Orthids, some of which are identical with, or are varieties of, species of the Leirs limestone described by Billings. The few trilobites known are of Cambrian types, and include a *Cyclognathus* allied to *C. micropygus* and a *Euloma*. Several minute pteropods occur in these shales, with the graptolites.

Sir William Dawson, F.R.S., presented a paper "On the Correlation of Early Cretaceous Floras in Canada and the United States and on Some New Plants of this Period." The purpose of this paper is to illustrate the present state of our knowledge respecting the flora of Canada in the early Cretaceous, and to notice some new plants from Anthracite, N.W.T., collected by Dr. H. M. Ami, and from Canmore, collected by Dr. Hayden. It is a continuation of the author's paper on the "Mesozoic Floras of the Rocky Mountain Region of Canada," in the Transactions of the Royal Society of Canada for 1885.

Sir William then introduced Dr. Ami's paper "On the Occurrence of Graptolites and Other Fossils of Quebec Age in the Black Slates of Little Metis, Que." The paper contains notes on, and descriptions of, graptolites and other fossils from a small but interesting collection made by Sir William Dawson in rocks closely related to those from which the remarkable fossils were described conjointly with Dr. George Jennings Hinde.

Mr. J. F. Whiteaves, palæontologist and zoologist to the Dominion Geological Survey, read two papers, and introduced a third by Mr. Lawrence Lambe. In his first paper on the "Fossils of the Hudson River Formation in Manitoba," Mr. Whiteaves gives an historical sketch of the discovery and collection of fossils of that age, by Dr. R. Bell, in 1873; by Dr. Ells, in 1875; Dr. Bell, later, in 1879; and by Messrs. T. C. Weston and D. B. Dowling, in 1884 and 1891–92, respectively. The object of the present paper is to give as complete a list as possible of the fossils of this formation in Manitoba. There are now as many as sixty species in the Museum of the Survey at Ottawa. Mr. Whiteaves's second paper deals with "Notes on the Land and Fresh-Water Mollusca of the Dominion." Mr. Lambe's paper contains an account of the results obtained by that gentleman from a microscopical examination of recent sponges collected, in the waters of the Pacific, along the British Columbia or Canadian coast. The paper is entitled, "On Some Sponges from the Pacific Coast of Canada and Behring Sea." It will be illustrated with drawings made by the author, who is artist to the Geological Survey Department.

Professor L. W. Bailey, Ph.D., of Fredericton, New Brunswick, gives the result of his "Observations on the Geology of South-Western Nova Scotia," in the counties of Shelburne and Yarmouth. A careful description of the various contacts and occurrences of the auriferous rocks and other masses follows a review of the geological structure of the district in question. A geological map accompanies the paper.

"On Palæozoic Corals" is the title of Professor Chapman's contribution to palæontological science. It is an attempt to simplify the determinations of genera in the so-called "Tabulated and Rugose Corals of Palæozoic Rocks."

Dr. Wesley Mills's paper on "Hibernation and Allied States in Animals" referred to the winter sleep of groups of animals below vertebrates, hibernation in cold-blooded animals, hibernation in certain groups of warm-blooded animals, experimental study of the winter sleep of the bat, and especially of the marmot and allied states in man; all of which was followed by a discussion of the true nature of all such phenomena.

Dr. George Lawson presented two important contributions to botanical research. The one bore "On the Literary History and Nomenclature of the Canadian Ferns," the other consisted of "Notes Supplementary to the Revision of Canadian Ranunculaceæ." The object of these notes, the author said, was to bring together such additions as have been made to our Ranunculaceæ by Canadians and others since the first paper was published, in 1883; also to discuss certain moot points in nomenclature and specific relations, that have been started by French, German, and United States writers in botany; further, to bring our knowledge of the Dominion Ranunculaceæ up to date.

Rev. Moses Harvey of St. John's, Newfoundland, and a new fellow of the society, contributed a most important paper "On the Artificial Propagation of Marine Food-Fishes and Edible Crustaceans." This paper deals extensively with the rise and progress of pisciculture, the importance of modern fish-culture, artificial increase of fresh-water and anadromous fishes, also the results obtained by private and national enterprises. Aqui-culture may yet approach agriculture in usefulness. Scientific study of fish-life and the physics of the sea bore intimately on the value of fisheries. The work carried on by the United States Fish Commission, by the Canadian Department of Fisheries, and the success of Norwegian pisciculture, along with the great results already obtained by lobster hatching with the Nielson process, are all discussed by Dr. Harvey, and many important facts of great economic value are noted. The paper ends by calling attention to the need of fishery schools and biological stations in Canada, for the study of fish, and other animals of the sea, of most importance to man. These are of national importance.

Mr. James Fletcher, F.L.S., and Dominion entomologist, contributed two papers in that branch of work. The first was entitled, "Report on a Collection of Coleoptera made on the Queen Charlotte Islands by Rev. J. H. Keen and J. Fletcher;" the second, "The use of Arsenites as Insecticides." Both proved highly interesting and useful.

At the closing general meeting of the society the following were elected to office: president, Dr. J. G. Bourinot; vice-president, Dr. George M. Dawson; honorary secretary, Mr. James Fletcher; honorary treasurer, Dr. A. R. C. Selwyn. In Section III. and IV., which deal more particularly with science and scientific work, the following were elected officers of sections: Section III., president, Professor E. J. Chapman; Section IV., president, Mr. Whiteaves; vice-president, Professor Macoun; secretary, Professor D. P. Penhallow.

The discussions which took place on the papers read were lively throughout, and interesting points were brought to light.

The Royal Society of Canada unanimously agreed to invite the Geological Society of America to meet in Ottawa in December.

NOTES ON STAR PHOTOGRAPHY.

BY ROMYN HITCHCOCK.

THE writer would beg the indulgence of those astronomers who may be induced by the title to read these lines in the expectation that they are the results of practical work in photographing stars. These, unfortunately, he cannot give; but inasmuch as the astronomers have so liberally availed themselves of the simplified methods of modern photography, which they can carry out more or less satisfactorily themselves, it is only fair that photographers should have a word to say now and then in behalf of the branch of investigation which they represent. By the term *photographers* I do not mean mere operators in the dark-room, nor amateurs who can make fine pictures, nor anything of the sort. I mean what may be best designated as photographic chemists, who are practically familiar with the subject from a chemical and scientific standpoint, and capable of conducting researches and designing and using apparatus for that purpose. It is certainly true that astronomers generally have neglected the surest means of achieving the highest success and advancement in their photographic work, in that they have undertaken to carry out themselves that part of it which ought to engage the attention of the highest skill and knowledge of the photographic chemist. So little is this fact recognized, that we actually sent a party to photograph the last eclipse of the sun in Japan, absolutely without either a photographer or a photographic outfit. So far from any effort to utilize the latest knowledge and methods for eclipse work, that expedition might easily have proved a total failure from the absence of the essentials for common work. When the expedition to the coast of Africa was fitted out, great attention was given to designing certain forms of apparatus; but, if I recollect aright, no photographer was chosen until a few days before its departure. Then a certain commercial brand of color-sensitive plates was chosen, but on what grounds, or whether the spectrum sensitiveness of those plates was tested at all, I have never learned. There will be an excellent opportunity for eclipse work next year; but if anything new is to be learned from it, the work of preparation should begin now in a photographic laboratory. We have apparatus enough, or we know perfectly well what is required, but we do not know the photographic process best adapted to the work.

It may be but an idle dream, but I hope to see a photographic laboratory established in connection with one of our large observatories or universities, not for routine work but for purely scientific research in photographic chemistry, such as will enable us to apply the latest knowledge to astronomical and spectrographic work.

An announcement has recently appeared, to the effect that the French astronomers have begun to doubt the value of negatives of stellar bodies taken on orthochromatic plates, because the stellar discs are surrounded by a strong aureola due to the aberration of the red rays of the objective. For this reason the permanent committee on the chart of the heavens has decided to exclude orthochromatic plates for such work.

I presume everyone finds some satisfaction in saying, "I told you so." The announcement leads me to publish now an article, on this subject, which was written in Japan between four and five years ago. It was perfectly clear to me at that time, that color-sensitive plates were being used in astronomical work when the very opposite kind of plates would have been much better for the purpose. Instead of extending the sensitiveness, it should have been restricted as much as possible. My article was not published because I deemed the facts too obvious to require discussion. But since M. Léon Vidal, editor of *Le Moniteur de la Photographie*, has taken, as I believe, an erroneous view of the matter in opposition to the practical results of the astronomers, I have looked up my old MS., and publish it herewith without change.

I would add that the opinion then expressed as regards the future of collodion plates, for all scientific work, has been greatly strengthened by the results of later investigations.

The article referred to is as follows: —

The so-called isochromatic, or orthochromatic, sensitive plates have been recommended for use in astronomical photography, in order to obtain impressions of red or yellow stars along with those having more blue and violet light in their radiations. Spectroscopic observations have shown that the light of different stars differs very much in the proportion of highly refrangible rays, and this difference must be of great influence in determining their photographic action. The ordinary sensitive gelatine plates possess a maximum of sensitiveness near the Fraunhofer line H, but some action can be traced into the yellow as the result of very long exposure, or even still further. For ordinary exposures, however, we may consider that the action does not pass the blue, particularly when photographing bright sources of light, such as the stars, because the more refrangible rays are so very much more powerful in their effect upon the plate that they exert their full action before the others can make a visible impression. To extend the time beyond that point would result in a reversal of the effect sought for, a change in the character of the negative, and serious irradiation or spreading of the light around the image, resulting in impaired definition. With ordinary sensitive plates, therefore, the images we photograph are images made with blue, violet, and ultra-violet rays, covering, indeed, a considerable range in the spectrum, but excluding a large and important portion of it.

The differences in the character of star radiations are so considerable that the blue is sometimes very strong and brilliant, even exceeding that of the sun relatively to the other parts of the spectrum, as we find it in α Lyræ and in Sirius; while in other stars the temperature is so low that there is scarcely any blue, and line-absorption gives place to flutings, or even to the bright lines of incandescence from comets and nebulæ. It is obvious, therefore, that one star not only differs from another in glory as seen by the eye, but the photographic plate, which takes no account of any colors beyond its limited range of sensitiveness, tends to exaggerate the difference, and give utterly false evidence of relative brightness. For a red star may appear very bright to the eye, while its image on the plate would be very faint or perhaps scarcely discernable.

With orthochromatic plates the result will be different, provided the telescope itself is not at fault. We will assume for the moment that the telescope is so constructed that the "chemical" and visual foci exactly coincide, and that the plates are equally sensitive to all the colors of the spectrum. Then the negative will show exactly what is seen by the eye, and these are the only conditions under which such a result can be perfectly attained.

Doubtless such perfectly corrected telescopes, or perhaps I should say such as are so corrected within the limits of the optician's skill, are rarely available, and a very usual plan is to make certain corrections for ordinary telescopes to adapt them to photographic work. The effect of these corrections now deserves consideration.

The difference between the so-called "chemical" focus and the visual focus of a telescope may be little or it may be half an inch. In either case the photographed image will be decidedly out of focus if allowance for this difference be not very carefully made. The usual means of doing this is to change the position of the plate-holder, and find the place of the sharpest definition by trials. By properly arranging the ground-glass and the plate-holder, the plate will always be in focus for the actinic rays when the image appears sharp on the ground-glass.

Having accomplished this result, we have succeeded in doing precisely what we do not wish to do, viz., instead of arranging the instrument to photograph what the eye can see, by means of the extended and uniform sensitiveness of an orthochromatic plate, we have arranged it to define only with blue or violet rays, and have restricted its range to stars that are specially characterized by highly refrangible radiations, effectually cutting off the red and yellow stars, and rendering the use of orthochromatic plates not only useess but positively objectionable.

As regards the red and yellow stars, the greater portion of their light will be brought to a focus at the point of distinct vision, not on the sensitive plate; and the feeble radiations of higher refrangibility, being too weak to act strongly upon the plate, such stars will be but faintly shown in the negative. The rays not focussed on the plate will tend to blur the images, and this effect will be more pronounced and objectionable in proportion as the range of sensitiveness of the plate to the different parts of the spectrum is increased. For this reason the most perfect pictures would be produced, under the conditions described, by using plates sensitive only to the particular rays that form the image on the plate, or else by cutting off the other rays by a screen, thus working with monochromatic light.

It is possible that there may be some object in photographing stars with the different colors of the spectrum separately, in which case orthochromatic plates can be so prepared that they will select the particular light required, and such observations may be made with ordinary telescopes, correcting them for each set of rays in turn, in the manner described. But if I correctly understand the purpose of photographic star-maps, they are intended not only to represent the distribution of stars and their relative positions, but also to show their respective brightness, or, as we usually call it, magnitudes. Now magnitude measured by brightness is not the same as the photographic action of the stars upon a plate of restricted spectrum sensitiveness, such as all ordinary sensitive plates, and this, although a self-evident proposition, has not received in practice the attention it deserves. On the other hand, orthochromatic plates will give perfectly truthful representations of the starry heavens when used with perfectly corrected telescopes, as already explained, and that they will only do so under such conditions is, I believe, obvious.

If it is possible to make plates of uniform sensitiveness as regards tests in the sensitometer, and also as regards all the rays of the visible spectrum, and if such plates can be produced regularly in large quantities, we may consider the problem of photographing the stars to be satisfactorily solved. But much yet remains to be done before a plate that can be regarded as standard can be adopted. The composition of the emulsion, the manner of rendering it sensitive, the means of testing the plates, including the standard of light to be used in the process, and the keeping qualities of the plates, must all be thoroughly investigated before it will be safe to adopt a standard plate for universal use. Nevertheless, we are in a position now to begin practical work, and the results will be of permanent value if we act upon the proposition that with orthochromatic plates there is no distinction of chemical and visual rays, and that such plates can only be advantageously employed when all the rays from red to ultra-violet are brought to a focus in a single plane.

I do not venture upon any speculations as to the probably best method of preparing color sensitive plates for astronomical work, for the reason that new methods are constantly being tried. I will say, however, that I deem it not at all improbable that collodion will be found superior to gelatine as a vehicle for the emulsion, and although the gelatine plates are at present more rapid than collodion emulsion plates, there is no obvious reason for this, further than that we not yet know how to make extremely rapid plates with collodion. But there are some objections to gelatine and none to collodion. Gelatine swells in water, particularly in warm climates, and, although this defect can be to some extent controlled, it is really at times a serious trouble, which no "tropical" plates can entirely overcome without a sacrifice of other good qualities.

The great point in favor of collodion is that it seems to lend itself peculiarly well to the production of color-sensitive plates, and this, coupled with the uniformity of the material that can by proper means be secured and the clearness with which it works, leads me to anticipate that it will eventually rival gelatine for fine, delicate work, and I believe it will come to be highly favored in astronomical work and spectrographic work.

Washington, D.C., June 10.

GLACIAL PHENOMENA IN NORTH-EASTERN NEW YORK.

BY D. S. KELLOGG.

CLINTON COUNTY, the very north-eastern county of New York, offers an interesting field for studying glacial phenomena. The rock striæ generally are nearly north and south, though in one place at least they are almost east and west. In many places the outcropping ledges are oval mounds with their longest diameters in the general direction of the supposed motion of the glacier.

There is an abundance of marine shells everywhere in the lower lands. These may be near the present surface and turned over by the plow in such quantities as to make the fields white, or they may be found from 5 to 10 feet under ground. A stratum 2 inches thick underlies much of Plattsburgh village at a depth of 5 or more feet. These are *Saxicava arctica* and *Macoma greenlandica*. Others undoubtedly are present in this county. The highest I have yet found are 346 feet above tide-water.

In Beekmantown ends a tortuous kame, over 50 feet high, which has been traced and mapped north into Chazy, 6 miles. Much of this is laid down upon clay of the former lake-bottom.

The lower slopes of Rand Hill and of Dannemora Mountain are covered with deposits of till, which wells of 50 feet do not go through. I have been over much of this surface for a distance of 20 miles north and south and of 6 miles east and west. There are scores of kame-like ridges from 5 to 70 feet high, generally running north and south, but sometimes in all directions. These ridges form a large number of swamps, varying in size from half a square mile down to a few rods. The bowlders and cobble stones in these deposits are largely of sandstone, which crops out in immense surfaces in the northern part of the county, and probably lies underneath much of this till. At Cadyville in the Saranac valley, 10 miles from Lake Champlain, the glacier moved across the old valley, making by its deposits a dam 2 miles wide and upwards of 100 feet high. This dam made a lake 8 or 10 miles long, 2 miles wide, and in places 100 feet deep. This lake has been entirely emptied out. The Saranac River has not only cut a channel through this till dam, but has also made a gorge 60 or more feet deep in the sandstone that underlay the lower half-mile of the dam. Probably the old buried channel is not far distant. What was once the bottom of a portion of this lake is now known as the "seven-mile run" in the Saranac River.

The Lake Champlain of the closing glacial period reached up to the lower border of this glacial dam, 500 feet higher than the present lake and 600 feet above the sea. When at its highest level a plateau was formed that extended 2 miles or more out in the lake. After a time the lowering of the lake by the erosion of its outlet left this plateau uncovered. Then a second was formed, perhaps 250 feet lower than the first, spreading out several miles. A third lowering formed a third plateau, on which much of Plattsburgh village now stands, and which makes "The Plains," south. This third plateau in general is from 50 to 75 feet above the present lake, and, like the other two, is composed mostly of sand. Nearly all the time while these plateaus were forming, the outlet of Champlain was south into the Hudson.

A dam of 60 feet now in the Richelieu would throw the Champlain water into the Hudson, unless there is a lower valley out from the Missisquoi Bay. By erosion of the valley from Whitehall to Fort Edward the lake was lowered until the ice had retreated enough to allow the Richelieu to be made. I have not studied the conditions between South Bay and the Hudson. For a time this may have been one of the southern outlets of Champlain. The Champlain Canal at Fort Edward receives its water from a feeder which taps the Hudson at Glen's Falls. *This* water from the Hudson flows north now from Fort Edward in the canal, and empties into Lake Champlain.

Did the pre-glacial upper Hudson flow through into the old river bed which is now Lake Champlain and thence into the St. Lawrence valley?

Plattsburgh, New York, June 13.

NOTES AND NEWS.

IN a circular, "American Reports upon Anatomical Nomenclature," issued last winter by Professor Wilder, as Secretary of the Committee of the Association of American Anatomists, in the third paragraph of the third page, the Chairman of the Committee of the Anatomische Gesellschaft should be Professor A. von Kölliker, and the chairman of the American division (appointed in 1891 by the American Association for the Advancement of Science) of the International Committee on Biological Nomenclature should be Professor G. L. Goodale. Professor Wilder desires to express his regret for the errors, due in the one case to his own misapprehension and in the other to a clerical mistake.

—Professor Bardeleben has recently delivered an address in Berlin on the modern bullet (*British Medical Journal*, May 21). The modern rifle sends a bullet with a narrow cylindrical form and pointed apex, which at a distance of 1,000 metres has the power to pass through several human bodies or to disable two horses. Its line of flight differs but slightly from the line of sight. It has an inner core of lead enclosed in a casing of steel which prevents the lead from becoming deformed and spreading at the point of contact. This change is of much interest for military surgery. The bullet is lighter than any of the lead bullets, but is sent with a greater velocity. On account of its velocity and its small surface of contact, it merely punches out a hole causing very little commotion of the neighboring parts. It is more likely to cause fatal hæmorrhage than the old bullet. If the new bullet wounds at all it will have sufficient power to pass through any part of the body. Colonel Boonen-Rivera, in his report on the civil war in Chili, the only war in which Mannlicher rifles have been used, says that the number of dead on the battlefield was four times larger than that of the wounded. The effect of these bullets on bone has been made the subject of a series of experiments. Up to a distance of 400 metres the bone is invariably shattered, and at greater distances either clean perforations or oblique fractures result. In the next war the ratio of recoveries of those who can be removed still living from the field will be larger than formerly. The new projectile is by no means so humane as it is sometimes called, since within similar periods of time and under equal conditions it kills and wounds more men than the old bullet. But the wounds which it causes, if they are not of a directly fatal nature, open to the surgeon, as a general rule, a far more promising field for exercising his skill and activity than those which were caused by the old bullet.

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CURRENT NOTES ON ANTHROPOLOGY.—VIII.

[*Edited by D. G. Brinton, M.D., LL.D.*]

The Palaeo-Ethnology of Mahgreb.

UNDER the name Mahgreb (*Beled el Mahgreb*, Land of the West) the Arabs distinguish that portion of Africa west of the Nile Valley, and north of the southern boundary of the Sahara, from the Soudan (*Beled es Sudan*, Land of the Blacks). It is a convenient geographic term, and as we have adopted Soudan we may as well also take Mahgreb, especially as it is a well-marked ethnic area. It is and has been from time immemorial the home of the Berber, or Hamitic, or Proto-Semitic peoples, as they have variously been termed.

In a late number (April 9) of the *Revue Scientifique*, A. Chatelier gives an admirable summary of the prehistory of this region. Signs of Palæolithic man abound in all parts, carrying his residence far back into the quaternary, when quite different geographic distributions of water and climate prevailed from the present. He was succeeded, apparently without a hiatus, by neolithic communities, who developed the art of stone-implement making to great perfection. Their numerous workshops and village sites occur on the watered lowlands, showing that the physical geography of the country had then reached its present state. The neolithic industry continued to nearly the Christian era, flint chips being found in tumuli overlying Roman remains. There are also many rock-drawings belonging to this period, rude, but revealing Egyptian inspiration in the costumes depicted, the human figures with ibis heads, etc.

But the most striking features of the prehistoric remains are the megalithic structures, the dolmens, menhirs, cromlechs, triliths, stone circles, etc, which are abundantly scattered over the soil from Fez in Morocco to the Tripolitan plateaux, where they abruptly cease, none extending into Egypt. These were undoubtedly constructed by the ancestors of the present Berber population. They not only claim them as the tombs of their forefathers, but to this day some of the tribes surround their cemeteries with similar stone circles, called *Heuch*, That they were in common use at a late date is proved by the discovery in some dolmens of iron and Roman coins; and that these relics were of contemporary date and not intrusive, is proved by the presence of several structures of this character in southern Tunisia, built on an old Roman road.

That precisely similar megalithic remains are found in Palestine, is explained by the presence there of the Amorites and other true Hamitic tribes; that they can be traced in a continuous line across the Straits of Gibraltar, through northern Spain and France to England and Denmark, and not beyond, offers a suggestive hint concerning the prehistoric migrations of the Mediterranean peoples.

The conclusion which M Le Chatelier especially impresses on his reader is, that the same Berber stock has possessed Mahgreb, so far as all evidence goes, from the very earliest times of which we have any cognizance down to the present day.

The Prehistoric Culture and Commerce of the Mediterranean.

Archæological research is rapidly dispelling the erroneous notions that the early civilizations of the Mediterranean were derived from Asia or Egypt; and that previous to the mythical advent of Cadmus, or the founding of Carthage and Rome, the coasts of this great sea were peopled by savages. In fact, one of the most brilliant periods of commerce and culture on the Mediterranean was about 1500 B C. At that date there were several centres on the European shore of high civilization, wholly independent and occidental in their ideals and technique; on the southern shore the Hamitic Libyans and Mauritanians had, by spontaneous development, reached a degree of culture quite up to that of their neighbors, the Egyptians. It is chiefly by the accident that their art-products have been better preserved, that we have hitherto attributed a superior grade of advancement to the latter. There is no reason for believing that the Egyptians were much in advance of the other nations of the Mediterranean basin at the close of the Old Empire. The introduction of metals was what chiefly led to the predominant influence of oriental ideas. This event occurred between 1500 and 1200 B.C.

These opinions, which are now gaining general credence, are well set forth in a volume published lately in London, by Professor W. M. Conway, entitled "The Dawn of Art in the Ancient World." It would be easy to support his views by abundant evidence.

On Ethnic Nosology.

Differences in races are not confined to matters of anatomy and physiology, but show themselves to a marked degree in special liability to, or immunity from, certain classes of diseased conditions. This has attracted the attention of the medical profession from time to time, but only recently, since the discriminating traits of races have been more closely studied, has it received proper attention. In this country the practitioner who has treated of it most extensively is Dr. Albert S. Ashmead, of New York City. His articles on racial immunity and inoculation, on the ethnic extension of syphilis, leprosy, tuberculosis, yellow and scarlet fevers, have appeared in various medical journals, and embody a mass of instructive observations on the relative presence of these complaints in different peoples.

The study of the causes of racial immunity from disease has a very practical side. When we find, for instance, that the Japanese are not liable to scarlet-fever, and the negroes are equally exempt from yellow-fever, if we could ascertain what condition it is that confers upon them this exemption, we might be able to take a long step in the direction of personal and general prophylaxis. There is no more vital question, none more attractive to the most active minds of the medical profession to-day, than this of immunity; and in the direction of ethnic immunity there lies a wide avenue for investigation promising to lead to results of the utmost utility to the health and welfare of mankind.

The Builders of the Great Zimbabwe Ruins.

Among the auriferous reefs of Mashona-land, in south-western Africa, about 20° south latitude, are found a number of remarkable ruins of well-built stone cities, towers, and forts, which have long been an enigma to archæologists. Needless to say, they were not constructed by any Austafrican people; no negro or negroid race ever built stone walls voluntarily. The problem seems to be solved by the researches of J. Theodore Bent, which are published in the last number of the Proceedings of the Royal Geographical Society. He visited and explored the ruins of the largest city, called the Great Zimbabwe. This being a word of the local dialect, meaning krall or town.

His excavations show that these ruins were built and occupied by a people engaged in gold-mining. Crucibles and smelting furnaces were found, and in the vicinity "millions of tons" of quartz have been worked over. The stone work is massive, very firm, the stones often carved and decorated, and the sites usually of great strategic strength. Many images of birds, carved in stone, and also many phalli, in the same material, were unearthed. Pottery was abundant, the fragments often decorated with neat designs of animals, plants, and scenes from life. No coins were exhumed, and no inscriptions discovered, except some rude scratchings on a bowl, which resembled Ogham characters. What is significant, is the presence in the *débris* of Persian and Chinese Celadon pottery, which is not of very ancient date. Bent's conclusion is that the gold-seekers were Himyarites from southern Arabia, and that their settlements were destroyed by the savage Zenj from Abyssinia about the ninth century of our era.

Many consider this to be the Ophir of the Hebrews. An interesting visit to it, not mentioned by Bent, is described in the *Verhandlungen* of the Berlin Anthropological Society for 1889, carried out by a young German named Posselt. Both accounts present engravings of carved stones, figures of birds, etc.; but it is singular that neither explorer could find a single grave or skeleton of this ancient people.

THE PROPER MOTIONS OF THE STARS.[1]

BY W. H. S. MONCK.

SOME time since I pointed out in the columns of the *English Mechanic* the great preponderance of proper motions in diminishing right ascension in certain catalogues which I examined. I have now examined O. Struve's great Pulkova Catalogue, which contains the proper motions of nearly 2,500 stars, with a similar result. About two-thirds of these motions are in decreasing right ascension. I suspect that the sidereal year has been under-estimated by a small fraction of a second, in consequence of which a star whose proper motion is really insensible appears to have a small motion in decreasing right ascension. The effect of the sun's motion in space is very evident in the Pulkova Catalogue. The right ascension of the apex of the sun's way (the Americans use the shorter term, goal) may be roughly taken at 18 h. The effect will be to produce an apparent motion in diminishing right ascension on all stars between 6 h. and 18 h., and an apparent motion in increasing right ascension on all stars between 18 h. and 6 h. Diminishing right ascension predominates in both cases, while in the latter the excess is only about 20 per cent.

I noticed, however, a curious fact as regards the motions in North Polar distance. The sun's motion produces an apparent increase in North Polar distance in all parts of the sky save the portions situated between the apex and the North Pole on the one hand, and between the antapex and the South Pole on the other. But taking the right ascension of the apex at 18 h., as before, the motions in North Polar distance ought to be symmetrically situated between 6 h. and 18 h. and between 18 h. and 6 h. But this is not the case. Between 18 h. and 6 h. the proportion of increasing to diminishing North Polar distances is two to one, while between 6 h. and 18 h. it is only about four to three. It occurred to me that this difference might arise from some special drift in the stars of the Galaxy, of which a comparatively small number lie between 6 h. and 18 h. in the Pulkova Catalogue, which deals chiefly with northern stars. I accordingly tried Mr. Stone's "Catalogue of Southern Stars," which so far verified my conjecture. The great preponderance of increasing North Polar distances in it lie between 6 h. and 18 h., and the relative proportions are not very different from those in the Pulkova Catalogue reversed. Further examination will be necessary to clear up the question; but I venture to suggest that the Galaxy has a southerly drift relatively to the majority of the non-Galactic stars, and that we would obtain different goals for the sun from the Galactic and the non-Galactic stars.

May I add that in dealing with the fixed stars our present unit of distance—a year's light-passage—seems to me inconvenient. Besides the advantage of having a space unit instead of a time unit, and the existence of some little uncertainty as to the rate of propagation of light; we must recollect that our standard of measurement is the distance of the sun from the earth. The time occupied by light in traversing this distance is uncertain to the extent of at least two or three seconds, and the difference becomes considerable when we are considering very remote bodies. I venture to suggest as a better unit the distance of a star having an annual parallax of 1″. This distance is 206,265 times that of the sun. The distance of α Centauri on this scale is about 1.33 and Sirius about 2.5 We should seldom, if ever, have to use numbers as high as 1,000, and the reciprocal of the parallax expressed in fractions of a second would in all cases give the distance.

[1] From the English Mechanic, May 27.

THE PEAR-TREE PSYLLA.

BY J. A. LINTNER.

UNTIL within a few years the pear-tree has been remarkably free from insect attack, the amount of injury from such source being probably less than five per cent of that to which the apple has been subjected. Recently two pests have forced themselves upon the notice of pear growers, which have already inflicted serious losses, and threaten, unless arrested, greatly to interfere with the cultivation of this most excellent fruit. Of these, the pear midge, *Diplosis pyrivora*, which was introduced in this country about the year 1880, has not become broadly distributed, and has not occasioned much trouble except in western Connecticut and in portions of the Hudson River valley.

The pear Psylla, *Psylla pyri*, also an importation from Europe, has been with us at least from 1850, when, as recorded, it infested an old Virgalieu pear-tree in Greenbush, N.Y. Since then it has become quite widely spread, and seems to be rapidly increasing in number and in the injury that it is doing. It was very destructive last year along the Hudson River in Columbia and Greene Counties. Mr. Powell, an extensive fruit-grower in Ghent, Columbia County, has stated that it reduced his pear crop from an estimated yield of twelve hundred barrels to an actual one of less than one hundred barrels. Mr. A. F. Coe, of Coe Brothers, owners of large orchards in Meriden, Conn., has written me that on his return from Europe last September, he found that two of his pear orchards had been devastated by the Psylla.

It is a small suctorial insect, somewhat resembling in size and in its transparent steep-sloping wings the typical plant-louse, but is readily distinguishable from that in its being a jumping insect, whence it has been given the name of *Psylla*, meaning in the Greek a flea. Its injuries are caused by the large amount of sap which the myriads of individuals draw from the twigs, buds, leaves, and leaf-stalks of an infested tree, and the "honey-dew," which it freely deposits, thickly coating the surface and thereby preventing the normal vital action of the bark and leaves.

Without consuming space with a detail of so much as is known of its life-history, suffice it to say that at the present time, or about the middle of June, the insect in its four stages of egg, larva, pupa, and imago may be found upon infested trees, and an abundant deposit of the honey-dew. Later in the season the winged insects are more numerous, and at the time of gathering the fruit, as the branches are disturbed, they have been reported as "flying up in clouds from the foliage."

With the appliances now at our command it should not be a difficult task to check and control the ravages of this pest. Its most vulnerable period is doubtless, as in the Aphididæ, at the hatching from the egg. At this time proper spraying with a kerosene emulsion will be fatal to it. If the spraying be deferred until the larvæ have become half-grown, the presence of the honey-dew would interfere with the action of the kerosene. Early spraying should also kill such of the eggs as may be reached by it, but many are placed in positions where they are almost entirely protected.

When the insect has passed to its winged stage, it has attained comparative immunity in the alertness with which it takes wing and leaves the tree upon the first motion communicated to the foliage by the impact of the spraying liquid. But even so late as this the war against the insect should not be abandoned, for multitudes may be destroyed, and the egg-crop for the following year greatly reduced. The kerosene emulsion will still be effective, but in its application all of the ordinary spraying-nozzles should be discarded, even the finest gauge of the Nixon nozzles, and a Vermorel used, adjusted to the delivery of the finest possible mist-like spray. With proper care the emulsion may be distributed over the entire foliage without scarce stirring a leaf and with the least possible alarm to the winged tenants. Of those that take wing — after circling about the tree for a while — on their return to the leaves, their bodies will in most cases come in contact with the liquid and cause their death.

Office of the State Entomologist, Albany, June 13.

THE TECHNICAL EDUCATION OF THE ELECTRICAL ENGINEER.[1]

BY DUGALD C. JACKSON.

PERHAPS it would be well to call my subject the "College Education of the Electrical Engineer," for it is strictly of the technical college course that I shall speak. We can truly affirm that the technical education of an engineer does not end until his work is ended, and the college course is but the commencement of it. That the college course can be made a very important fundamental part of this education, is becoming more thoroughly appreciated as the work of the technical schools comes into closer harmony with the demands of the profession, and it is now generally agreed that a technical college course, of the proper kind, forms a valuable aid towards the success of the average young man who wishes to enter the engineering professions. It therefore becomes a matter of no little moment to so arrange the course that its usefulness will be a maximum. A few years back, a college course entirely devoted to the training of electrical engineers was unknown. At the present time there is no dearth of such courses and their organization is progressing right and left, whence it is well to carefully consider what requirements of the electrical engineer's profession they may be made to meet, in order that no powder be wasted. It is neither possible nor desirable that the courses of study of electrical engineering students in the various schools should be alike, but a certain unity of purpose and treatment should be observed, and all can profit by the suggestions made by the practical man.

With this in view, I present the subject to your attention as it is looked upon at the Engineering School of the University of Wisconsin. There is no originality claimed for the ideas presented, as they are based upon the recorded experience of some of the country's most successful practical men, and are virtually followed in such other engineering schools as make their courses thoroughly practical, and therefore, in the true sense, professional. I trust, however, that a discussion will arise that is in proportion to the wide importance of the subject to the electrical profession, and that must result in a considerable increase in the efficiency of the electrical engineering courses in our various colleges, nearly all of which are still in process of crystallization.

In order to enter the freshmen class of the best engineering schools, the applicant must have a thorough common school education, including mathematics through ordinary algebra, a fair knowledge of English, a reading acquaintance with German or French, a little elementary physics and chemistry. This can be gained in the high schools of most of the cities of this country. The high school timber (some of it quite green) the college is required to work, and to work it to the best advantage requires no little careful designing. In order that an engineer may use his abilities and training most advantageously, he should have a good general education, including a fair knowledge of literature, history, economics and certain elements of law. This cannot be expected to come from the high school, and you can readily appreciate that an attempt to give a general education in an engineering course can only result in sacrificing the good of the students by omitting essential fundamentals. Thus, to have an average chance of proving successful, an electrical engineer must be well grounded in three sciences besides those gained in the common schools, and which can-

[1] A paper read at the General Meeting of the American Institute of Electrical Engineers, Chicago, Ill., June 6–8.

not be classed as engineering. These are: Higher mathematics, as far as it may be practically applied in engineering; chemistry and physics (including elementary electricity and magnetism); and manual training. A few students enter college who have been given a fair start in these, but they are the exception, consequently the subjects must be taught from the ground up, with a common-sense view to their practical applications. Unlimited time could be given to these preparatory subjects, but it is necessary to clear them away in the actual time of two college years. With this requirement, it is impossible to give a very thorough knowledge of analytical chemistry, or of physics, but they are taught so as to give the student a good working knowledge and so that he can readily go deeper if he finds it to his advantage in his future practical experience. The higher mathematics require all the time that can be afforded, especially in its last division, that of applied mechanics, where the student gets his systematic knowledge of the properties and uses of materials.

With the preparatory studies cleared away the student must enter into professional studies in earnest, but there is little time for true engineering. The developing electrical engineer must expand his physics and his chemistry and mathematics into the laws of electro-magnetism, alternating currents, electrolysis and electro-metallurgy, and study the conditions of their numerous practical applications in engineering and the arts, each of which may demand months of constant effort before an intelligent mastery is attained. Neither can he confine his attention to these during two full years, for he must gain an elementary but practical knowledge of thermo dynamics and hydraulics, with an efficient working knowledge of their applications in steam and water-power plants. He must also get a common-sense knowledge of the principles underlying the design, manufacture and selection of machinery.

This is a great deal to expect a student to efficiently absorb in four years, and it requires a most judicious selection in order that nothing unessential be allowed to enter and that nothing essential be omitted. Let us see how the selection is made at the University of Wisconsin. The arrangement of the fundamentals will first claim our attention.

During the first year the student is given a course of four subjects, continuing through the year. These are: 1st, English and rhetoric, with such reference to technical forms as seems desirable so early in the course; 2d, mathematics, beginning with higher algebra, passing through trigonometry and descriptive geometry, and into analytical geometry; 3d, advanced French or German, grammar and reader; 4th, manual training. In the latter, which continues during the following two years, we do not think it necessary or desirable for the student to spend sufficient time during his course to become a carpenter, machinist, blacksmith or foundryman. His future calling will probably not demand that his wages be earned in either of these trades, but they are tributary to his profession, and he must have an intelligent mastery of the tools, and an appreciation of shop requirements. In order that some future day he may become a successful designer, or a useful shopman or superintendent, it may be desirable for him to take a properly arranged apprentice course in a first-class commercial shop, after completing his college course. Mathematics are also continued through the second and third year, during which time analytic geometry, calculus and applied mechanics are passed through. All mathematics are taught with especial view to future practical applications, and good use is made of the laboratory in applied mechanics. During the second year of the course, elementary chemistry and physics are disposed of, and here again the laboratory is put to good service. At the same time, work in draughting and the elementary designs of machines is begun. The third year is about half, and the fourth year wholly devoted to what may properly be called professional studies. The arrangement of the latter in the electrical engineering course, we will examine later.

Upon completing his technical college course of four years, an average student has spent at least 144 weeks of hard study, much of it of a practical work-day nature. During this time he has been called upon to spend upwards of five hours per day in class-room and laboratories, and about as much more time in individual study. No one is likely to go satisfactorily through such a course unless he has a decided taste for engineering work, but many students find themselves capable of doing a considerable amount of extra work, and yet have sufficient time for recreation to keep their health and spirits. It is well for an engineering course to stand beyond the reach of students without a taste for the work, for a successful engineer must be pre-eminently an enthusiast, while he is at the same time a candid and careful thinker. Those who are not fitted by nature to become engineers, are better placed in a general educational course at college, and they are then more likely to become useful to society and to themselves than if passed through the technical mill.

It may here be asked, Of what use is the severely specialized education to the successful student in the engineering courses? The graduate does not become an engineer merely because he has successfully met the college examination. College cannot make an engineer, however practical the course of study may be. Practice has made thousands of good ones, without the aid of the college, but I venture to say that these would frequently have become more eminent if they had received a thorough technical college course. While theory alone, wherever learned, cannot make a practical man, it is the one who can follow the guide of theory, along the paths of practical work and experience, who makes the fully-developed engineer. In order, however, that neither theory nor practice may lead him astray, he must have a well-educated common sense. The eminent and eloquent engineer, Alexander L. Holley, well illustrated this in one of his addresses, when he said: —

"Mere familiarity with steam-engines is not, indeed, a cause of improved steam engineering, but it is a condition. The mechanical laws of heat were not developed in an engine house, yet without the mechanism, which the knowledge derived through this familiarity has created and adapted, the study of heat would have been an ornamental rather than a useful pursuit. So in other departments. . . . When one in any art can make a diagnosis by looking the patient in the face rather than by reading about similar cases in books, then only may he hope to practically apply such improvements as theory may suggest, or to lead in those original investigations upon which successful theories shall be founded."

The true object of the technical college is here outlined. It is to teach the fundamental theories, with a common-sense view to their practical applications, in such a way as to aid in a diagnosis, not by the application of a mathematical formula, but by comparing the accumulated experience of the practical world. Take two young men of equally good ability and equal age; put one through a thorough technical college course and the other through an apprenticeship of the same length of time. Finally, put them side by side in a working position, where they must work out their own salvation, and the college man will usually have more ambition and adaptability, and will outstrip his mate, though perhaps not at once. The college man may fall behind at first, but, having worked through the transition period, he will prove the winner. I venture to say this is the well-nigh universal experience of those who have had the opportunity of dispassionately trying the experiment.

Another illustration of the advantage of the technical college course, lies with the designer. To design good machinery is a natural gift, and to become thoroughly successful requires long experience, in order that the widely varying requirements may each be given due weight. Proper instruction at the technical school may here do much towards stimulating an appreciation of the lessons of experience. The considerations of primary importance to be followed in designing machines, are admirably divided by Professor A. W. Smith into four: 1, Adaptability; 2, strength and stiffness; 3, economy; 4, appearance. In developing the design of a machine, the practical, but highly sanguine inventor often forgets all the considerations except the first. A theoretical draughtsman may figure the strength to great precision by formulas that may not fully cover the required conditions, and in the meantime forget the other considerations. When the design reaches the shopman, it must be altered to suit his views of economy, as the prime factor. A machine is thus produced that has lost part of its adaptability as designed, and has neither sufficient stiffness to properly do its work, nor a thoroughly substantial, workmanlike appearance. The economical shopman has been defeated in his object, for the machine is hard to sell, or requires costly repairs at the expense of the maker. A proper college course should sufficiently broaden a man, so that he can quickly appreciate the demands of the prime considerations of practice, and will apply his formulas with common sense and moderation. If we replace our three men in the machine transaction by men of equal experience and a technical college education of the right sort, the work of each should supplement the work of the other, and the product can be predicted, with some confidence at least, to be a satisfactory commercial one. The fault of much of the college training for engineers, has been the lack of this education of the common sense or judgment. The result has often been graduates with as great a contempt for the practical man as the latter could return. These graduates have, it is needless to say, been a failure in their calling, and it is such men that technical colleges should not turn out. The best engineering schools desire to, and do, turn out men who have a capacity for practical work and research, and who are in a fair way to make useful engineers.

It is comparatively easy to properly teach the fundamental theories, hence it is so frequently overdone. It is not so easy to educate the judgment of a student in electrical engineering, whose entire knowledge of his future profession has been acquired from the electric bells in his father's house, and who may never have examined a dynamo or storage battery until he visited the college laboratories. But it is wonderful how rapidly such students, when of good timber, absorb a beginner's information and a thirst for investigation. In this part of a student's education, the manufacturers and large users of electrical apparatus, who have become directly or indirectly interested in the work of the graduates, can assist with little direct inconvenience and much indirect advantage. In a properly organized technical school, as shown above, the student gains his fundamental theory during the first three years, and, if of good timber, he will absorb much of the practical methods of thought required for successful after-work. Moreover, a considerable part of the third year is spent in practical instruction. As the fourth year is wholly spent in practical training, or the education of the common sense, the student must have some acquaintance with the methods of commercial work before entering it, in order that he may properly profit by the instruction. It is impossible for many, and doubtless undesirable for the majority, to take a year from the midst of their college course for outside work. The summer vacation between the third and fourth years should, therefore, be occupied in some such employment as wireman on electric light or telephone construction, or better, in the station and repair-room of an electric railway, under the eye of an appreciative superintendent. Three months spent in this work may seem very little, but it will do a deal of good in giving an apt student a fair idea of how far exact formulas will carry him. It is only by the generous co-operation of employers, that students can obtain this summer's work. At first thought it appears that the employer gains no advantage from it, but, upon careful consideration, an advantage is evident. To begin with, the properly trained student will not prove useless during the summer, and the satisfactory one will usually find employment after graduation, with the interests of those who afforded him summer work, and who thus gain the benefit of his greater advancement during his last year at college. In a similar manner, the manufacturer gains an advantage from placing his apparatus in the technical school laboratories for proper use in instruction.

Suppose a student has completed the prescribed college course, and has done a proper portion of repairing armatures, stringing wires, or similar work, at some interval between his terms at college, what shall we call him? A few of the technical colleges of the front rank call their graduates engineers, but we have already seen that they must pass through a transition period, during which the claim to the title can be proved. To call an untried graduate an engineer does not seem proper respect for himself or the successful workers in his profession. The transition period may never end for some graduates, while its length must always depend upon the man. Until the graduate has been in practical life a sufficient time to show his capacity, and has reached a position of responsibility, he has no right to claim from his college an engineer's degree. Upon this ground the University of Wisconsin, as do many others, confers degrees in engineering upon graduates of its engineering school of not less than three years' standing, who have held engineering positions of trust for at least one year. The minimum transition period is thus tacitly recognized as three years. Upon completing his college course, the student is given a graduating degree of Bachelor of Science by the engineering school, which is simply an endorsement by the University that he has received a good technical college education and is in a fair way to profit by it.

That the rigid specialization required in the technical school may not diminish the graduate's field of vision and thus his usefulness to society, is a matter of much concern. With the college left behind, there is little opportunity to gain a broadening culture, except that received by contact with broad men, while we have seen how little opportunity for this can be afforded in the technical course. With this in view, we recommend at the University of Wisconsin, that all who can afford the time and money complete a four-years' undergraduate course in the University School of Arts and Sciences before entering the School of Engineering. By proper elections during the general course, the studies of an engineering course can be completed in two additional years. By this plan a solid educational foundation is laid for the specialized studies of the engineering student, and the best conditions are developed for his ultimate success in professional work. The plan offers two other points of advantage: First, the student comes to his professional studies in the engineering courses with a more matured mind, which is of much importance; second, students without the taste for hard engineering work, which is required for their future success in technical industries, will not often attempt a technical course after having completed a general course.

We can now usefully inquire into the specialized work that should be prescribed for the average electrical engineering student during his last two years at college. Up to this point, students in mechanical and electrical engineering courses have received virtually the same instruction. Here, we hold, with several others, their paths should diverge. The student of mechanical engineering goes into careful study of shop practice, designing and utilizing various types of machinery, and similar subjects. The electrical engineering student must receive a good working knowledge of the problems of the mechanical engineer, but he must, above all, be trained in the practical problems of electrical engineering. He, therefore, goes into a study of that which will aid most in making him truly an electrical engineer. His knowledge must all be based on mechanical laws, but he must be much more than one-tenth electrical.

Before reaching his truly professional studies, the student should gain, during his course in physics, a common-sense grasp of the elementary notions of electricity and magnetism, and of the "all-pervading law of Ohm." The latter can be properly enforced in the laboratory by placing in the student's hands ordinary electrical instruments, such as bridges, galvanometers, amperemeters, voltmeters, etc. Before beginning his specialized work, the student's knowledge of Ohm's law and its common results should have become almost instinctive.

With due regard for his preparation, it seems best to arrange the professional studies for the average electrical engineering student in four divisions, thus:—

1. Electro-magnetism and its application to practical uses, with special reference to dynamos and motors.

2. Electro-chemistry (including primary and secondary batteries) and electro-metallurgy.

3. Alternating currents and alternating current machinery, including dynamos, converters, condensers, etc.

4. The special application of the preceding divisions in electric light, power, railway, mining and other types of plants.

The last division is allotted about twice the amount of time given to each of the others.

While higher mathematics is a useful aid in each of the divisions, its limitations as an agent must be carefully set forth in the class-room and laboratory. For the purpose of educating the judgment and fully defining the limitations of theories and mathematical deductions, the laboratory is indispensable. As much as one-half of the total time spent by the student under the direct instruction of the professors of electrical engineering, should be devoted to the laboratory. This work, moreover, should as far as possible deal with commercial instruments and machinery, and actually follow the methods of testing and research used in practice. Physics, chemistry, mechanics, the steam engine, hydraulics, dynamos, electrolysis, alternating currents, and other subjects, should all be properly represented by a commercial laboratory equipment, which is made useful in every day instruction under the direction of a man who has had experience in similar commercial work. The laboratory method of educating the student is unfortunately too little developed in many of our engineering schools, but a strong movement has begun in most schools to increase it in efficiency and amount. At the University of Wisconsin, we carry the laboratory instruction as a part of the required work in every subject in which it is possible.

While the specialized course of the electrical engineering student during the last two years is largely devoted to strictly electrical engineering, he is also given proper class-room and laboratory instruction in useful allied subjects, such as the steam engine, boilers, water-wheels, laws of contracts, etc., as has been already explained.

Students who are mature and show that they can usefully specialize more severely than is done in the regular prescribed course, are permitted, by election, to devote a greater proportion of their time to either of the first three divisions already enumerated. Thus a student may have reason to know that a thorough course in electro-metallurgy will be specially useful to him. In this case, his work in the second division is increased beyond the course requirements, and his work in the first and third divisions is proportionately decreased. Other things being equal, a student who has thus arranged his course may graduate with his classmates who have followed the fixed course, as laid down. In the same way, a student of sufficient maturity, who feels assured of special advantages in the field of electric transmission of power or electric railways, may increase his work in the first or third divisions and proportionately decrease it in the second.

The student who satisfactorily completes a proper professional course at college, whether laid down in the college catalogue or carefully elected from that prescribed, is not likely to become one who "turns out results like a cornsheller, and never grows wiser or better tho' it grinds a thousand bushels of them." In order that he may have a fair opportunity of growing "wiser and better" in the practice of his art, he should be given reasonable encouragement. As Mr. Holley one time said, an understanding should obtain "among the owners, directors, and commercial managers of engineering enterprises that it is not a matter of favor, but a matter of as much interest to themselves as to any class, that young men of suitable ability, and of suitable preliminary culture, however acquired, should have an opportunity and encouragement to master the practical features of technical education in works, not as mere apprentices, but under reasonable facilities for economy of time and completeness of research."

A legend on the cover of a circular lately issued by the Engineering School of the University of Wisconsin, gives the true object of the technical college, when it says, "We do not aim to produce engineers, but to produce men with great capacity for becoming engineers." If our product is accorded the treatment advised by Mr. Holley (himself an experienced manufacturer), we feel sure the work of our school and of similar technical schools will not be useless.

Madison, Wis., May, 1892.

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.*

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

How to Protect Inventions in Foreign Countries.

IN my article on protecting inventions in foreign countries, the matter quoted below should be amended, as indicated, by adding the clause in italics.

"The term, 17 years, of a United States patent is not shortened by an application filed, within 7 months of the United States application, in Belgium, France, Great Britain, Guatemala, Italy, Netherlands, Norway, Portugal, Servia, Spain, Sweden, Switzerland, and Tunis, or within 6 months, in Brazil or San Domingo," *if the respective dates of the foreign patents are the same or later than that of the United States patent.*

The error occurred through no fault of yours; but you would greatly oblige me by entering the correction.

EDWARD P. THOMPSON.

New York, June 9.

THE current issue of *The Weekly Bulletin of Newspaper and Periodical Literature*, published at 5 Somerset St., Boston, is twice its usual size, containing a classified index of 1300 articles from recent numbers of the periodical press. The *Bulletin* catalogues the impotant articles in the leading daily and weekly papers and the monthly magazines of the United States and Canada, including *Science*. Its value to readers, writers, and students, is sufficiently indicated by its title, and, although still in its first volume, its success as evidenced by the current issue is a surprise to no one acquainted with its plan and purpose.

— A State Academy of Science was established in Ohio last December by a few of the workers in various departments, and held its first field or summer meeting at Akron on the 3d and 4th of June. Arrangements were made for its reception by the Akron Scientific Club, and these were carried out to the evident satisfaction of the members attending. Their number was, however, diminished by a heavy downpour of rain during the preceding night though on the two days of the meeting the weather was fine. A small steamer was engaged for the day, and both hosts and guests enjoyed together ample opportunities for study and collection, in all departments, on the banks and in the waters of several of the morainic lakes so numerous in the vicinity of Akron. In the evening a reception was held at Buchtel College, when short addresses of welcome were made by the mayor, the president of the college and the president of the club, and were suitably replied to by several of the visiting members. A short business session and a microscopic exhibition by the students completed the programme. On Saturday the members went by an early train to the Gorge of the Cuyahoga, where they spent the

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CALENDAR OF SOCIETIES.

Chemical Society, Washington.

May 12.—E. E. Ewell, The Carbohydrates of the Coffee-Berry; G. L Spencer, An Improved Extraction Flask and an apparatus for Rapid Drying over Sulphuric Acid; K. P. McElroy and W. D. Bigelow, Behavior of Chromates in Acetone Solutions. Adjournment was until November.

Biological Society, Washington.

June 11.—C. Hart Merriam, The Southern Fur Seal (Arctocephalus) at Guadalupe Island; Frederick V. Coville, Uses of Plants among the Panamint Indians; J. M. Holzinger, On Amarantus crassipes Schlectendal; C. Hart Merriam, The Death Valley Expedition.

Exchanges.

[Free of charge to all, if of satisfactory character. Address N. D. C. Hodges, 874 Broadway, New York.]

Taxidermist going out of business has quantity of finely-mounted specimens of North American birds, mammals and reptiles and skins of birds for sale, including a full local collection of bird skins, showing some great variations of species; also quantity of skulls with horns of deer and mountain sheep, and mounted heads of same. Will give good exchange for Hawk Eye camera with outfit. Apply quickly to J. R. Thurston, 265 Yonge St., Toronto, Canada.

For exchange.—A fine thirteen-keyed flute in leather covered case, for a photograph camera suitable for making lantern slides. Flute cost $27, and is nearly new. U. O. COX, Mankato, Minn.

To exchange; Experiment Station bulletins and reports for bulletins and reports not in my file. I will send list of what I have for exchange. P. H. ROLFS, Lake City, Florida.

Finished specimens of all colors of Vermont marble for fine fossils or crystals. Will be given only for valuable specimens because of the cost of polishing. GEO. W. PERRY, State Geologist, Rutland, Vt.

For exchange.—Three copies of "American State Papers Bearing on Sunday Legislation," 1891, $2.50, new and unused, for "The Sabbath," by Harmon Kingsbury, 1840; "The Sabbath," by A. A. Phelps, 1842; "History of the Institution of the Sabbath Day, Its Uses and Abuses," by W. L. Fisher, 1859; "Humorous Phases of the Law," by Irving Browne; or other works amounting to value of books exchanged, on the question of governmental legislation in reference to religion, personal liberty, etc. If preferred, I will sell "American State Papers," and buy other books on the subject. WILLIAM ADDISON BLAKELY, Chicago, Ill.

For Sale or Exchange for books a complete private chemical laboratory outfit. Includes large Becker balance (200g. to 1-10mg.), platinum dishes and crucibles, agate motors, glass-blowing apparatus, etc. For sale in part or whole. Also complete file of *Silliman's Journal*, 1862-1885 (62-71 bound); Smithsonian Reports, 1854-1883; U. S. Coast Survey, 1854-1869. Full particulars to enquirers. F. GARDINER, JR., Pomfret, Conn.

Wanted, in exchange for the following works, any standard works on Surgery and on Diseases of Children: Wilson's "American Ornithology," 3 vols.; Coues' "Birds of the Northwest" and "Birds of the Colorado Valley," 2 vols.; Minot's "Land and Game Birds of New England;" Samuels' "Our Northern and Eastern Birds;" all the Reports on the Birds of the Pacific R. R. Survey, bound in 2 vols., morocco; and a complete set of the Reports of the Arkansas Geological Survey. Please give editions and dates in corresponding. R. ELLSWORTH CALL, High School, Des Moines, Iowa.

To exchange Wright's "Ice Age in North America" and Le Conte's "Elements of Geology" (Copyright 1882) for "Darwinism," by A. R. Wallace, "Origin of Species," by Darwin, "Descent of Man," by Darwin, "Man's Place in Nature," Huxley, "Mental Evolution in Animals," by Romanes, "Pre-Adamites," by Winchell. No books wanted except latest editions, and books in good condition. C. S. Brown, Jr., Vanderbilt University, Nashville, Tenn.

Wants.

Any person seeking a position for which he is qualified by his scientific attainments, or any person seeking some one to fill a position of this character, be it that of a teacher of science, chemist, draughtsman, or what not, may have the 'Want' inserted under this head FREE OF COST, *if he satisfies the publisher of the suitable character of his application. Any person seeking information on any scientific question, the address of any scientific man, or who can in any way use this column for a purpose consonant with the nature of the paper, is cordially invited to do so.*

WANTED.—We want any and all of the following, providing we can trade other books and magazines or buy them cheap for cash: Academy, London, vol. 1 to 28, 35, Jan. and Feb., '89; Age of Steel, vol. 1 to 66; American Antiquarian, vol. 1, 2; American Architect, vol. 1 to 6, 9; American Art Review, vol. 3; American Field, vol. 1 to 21; American Geologist, vol. 1 to 6; American Machinist, vol. 1 to 4; Art Amateur, vol. 1 to 7, Oct., '4; Art Interchange, vol 1 to 9; Art Union, vol. 1 to 4, Jan., '44, July, '45; Bibliotheca Sacra, vol. 1 to 46; Godey's Lady's Book, vol. 1 to 20; New Englander, vol. 11; Zoologist, Series 1 and 1, Series 3 vol. 1 to 14; Allen Armendale (a novel). Raymer's "Old Book" Store, 243 4th Ave. S., Minneapolis, Minn.

WANTED.—By a young man, a Swarthmore College junior, a position as principal of a public high school in one of the Gulf States, or as instructor in botany, physiology, and geology in an academy or normal school. Address B., care of Librarian, Swarthmore College, Penn.

WANTED.—A teacher of Geology who is familiar with the fossils of the Hamilton Group, as instructor of Geology during July next at the Natural Science Camp on Canandaigua lake. Apply to ALBERT L. AREY, Director, 229 Averill Ave., Rochester, N. Y.

WANTED.—To act as correspondent for one or two daily or weekly papers. Have worked on paper for about two years Would like a position on editorial staff of humorous paper. Address GEO. C. MASON, 14 Elm St., Hartford, Conn.

TRANSLATOR wanted to read German architectural works at sight (no writing). One familiar with technical terms desired. Address "A.," Box 149, New York Post Office.

WANTED.—A position in a manufacturing establishment by a manufacturing Chemist of inventive ability. Address M. W. B., care of *Science*, 874 Broadway, N. Y.

WANTED.—Books on Anatomy and Hypnotism. Will pay cash or give similar books in exchange. Also want medical battery and photo outfit. DR. ANDERSON, 182 State street, Chicago, Ill.

WANTED.—A college graduate with some normal training, to teach the sciences, at $1.800 per year, in a Southern college. A Baptist or a Methodist preferred. Must also be a first-class Latin scholar. A. H. Beals, Box K, Milledgeville, Ga.

ADDRESS WANTED.—Will some one please send the address of the Secretary of the American Philological Society. Also that of Herbert Spencer. "ADDISON," Room 84, 164 Madison St., Chicago, Ill.

day in a specially rich field for study in geology and botany, and where entomology was not lacking in opportunity. Those who were compelled to return took the afternoon trains, and a few who could remain assembled and took tea at the home of the president, where they spent the evening. The meeting broke up with the conviction that the first summer gathering of the young Academy had been a pleasant and successful occasion.

—In a paper read before the Washington Chemical Society, May 12, the carbohydrates of the coffee-berry were discussed by Erwin E. Ewell. Our knowledge of the carbohydrates has been materially extended during very recent years, in consequence of which investigation in this line has been greatly stimulated. Maxwell has demonstrated the presence of an insoluble, galactose-yielding carbohydrate; Reiss has reported an insoluble carbohydrate that yields mannose by hydroysis with dilute sulphuric acid. The water-soluble carbohydrates have received less attention; indefinite statements concerning sugar, gum, and dextrin make up the existing literature of the subject. By experiments made in the laboratory of the United States Department of Agriculture, cane-sugar, accompanied by small percentages of a substance resembling dextrin and some reducing sugar, has been shown to make up the water-soluble carbohydrate material of coffee. The cane-sugar was obtained in pure and well-defined crystals. A gum was prepared from the portion insoluble in water. The latter has been shown to be a galactose and pentose-yielding substance, and is now being studied farther. At the same meeting, K. P. McElroy and W. D. Bigelow described a new method for the qualitative separation of calcium and strontium, based on the solubility of calcium chromate in dilute acetone. The chlorides of these metals are dissolved in 50 per cent acetone, and a solution of potassium chromate in 50 per cent acetone added. After standing ten minutes no strontium can be detected in the filtrate, and the precipitate is practically free from calcium salts. These investigations will be continued with the hope that the separation may prove quantitative.

QUERY.

Can any reader of *Science* cite a case of lightning stroke in which the dissipation of a small conductor (one-sixteenth of an inch in diameter, say,) has failed to protect between two horizontal planes passing through its upper and lower ends respectively? Plenty of cases have been found which show that when the conductor is dissipated the building is not injured to the extent explained (for many of these see volumes of Philosophical Transactions at the time when lightning was attracting the attention of the Royal Society), but not an exception is yet known, although this query has been published far and wide among electricians.

First inserted June 19. No response to date.

N. D. C. HODGES,
874 BROADWAY, NEW YORK.

TO THE READERS OF SCIENCE.

PUBLISHER'S ANNOUNCEMENT.

OUR PLANS.

WITHIN the past six months the use of *Science* by scientific men and women as a medium for prompt publication and weekly discussion, has increased very materially, so that the pages are now well filled each week with original matter. As the number of those promising contributions is increasing at the rate of three or four each day, it cannot be long before *Science* at its present size will be too small for the amount of matter offered. We have under consideration therefore an enlargement of the paper by one-half, but must first learn the temper of our constituency as to an advance in price to $5.00, which was the subscription price from the start for four years, up to June 30, 1887. Further, to carry out the proposed enlargement, we shall need five hundred additional subscribers. If you are not already a subscriber, are you willing to aid in making *Science* more worthy of American scientific work by becoming one?

It goes without saying, that the demand for scientific literature is limited, when compared with that for literature which is more to the public taste, so that the receipts of most of the Scientific Journals, in this country, do not pay quite for their printing and paper, to say nothing of the other items of expense. We say this merely to emphasize the fact, that generous and prompt support must be accorded this move if it is to succeed.

Titles of Some Articles Published in *Science* since Jan. 1, 1892.

Aboriginal North American Tea.
Actinism.
Amenhotep, King, the tomb of.
Anthropology, Current Notes on.
Arsenical Poisoning from Domestic Fabrics.
Anatomy, The Teaching of, to Advanced Medical Students.
Astronomical Notes.
Botanical Laboratory, A.
Brain, A Few Characteristics of the Avian.
Celts, The Question of the.
Collection of Objects Used in Worship.
Deaf, Higher Education of the.
Diphtheria, Tox-Albumin.
Etymology of two Iroquoian Compound Stems.
Eye-Habits.
Family Traits, Persistency of.
Fishes, The Distribution of.
Fossils, Notice of New Gigantic.
Grasses, Homoptera Injurious to.
"Healing, Divine."
Hemipterous Mouth, Structure of the.
Hypnotism among the Lower Animals.
Hypnotism, Traumatic.
Indian occupation of New York.
Influenza, Latest Details Concerning the Germs of.
Infant's Movements.
Inventors and Manufacturers, the American Association of.
Iowa Academy of Sciences.
Jargon, The Chinook.
Klamath Nation, Linguistics.
Lightning, The New Method of Protecting Buildings from.
Lissajou's Curves, Simple Apparatus for the Production of.
Maize Plant, Observations on the Growth and Chemical Composition of.
Mineral Discoveries, Some Recent, in the State of Washington.
Museums, The Support of.
Patent Office Building, The.
Pocket Gopher, Attempted Extermination of.
Psychological Laboratory in the University of Toronto.
Psychological Training, The Need of.
Rain-Making.
Rivers, Evolution of the Loup, in Nebraska.
Scientific Alliance, The.
Star, The New, in Auriga.
Storage of Storm-Waters on the Great Plains.
Teaching of Science.
Tiger, A New Sabre-Toothed, from Kansas.
Timber Trees of West Virginia.
Tracheæ of Insects, Structure of.
Vein-Formation, Valuable Experiments in.
Will, a Recent Analysis of.
Wind-Storms and Trees.
Wines, The Sophisticated French.
Zoology in the Public Schools of Washington, D. C.

Some of the Contributors to *Science* Since Jan. 1, 1892.

Aaron, Eugene M., Philadelphia, Pa.
Allen, Harrison, Philadelphia, Pa.
Baldwin, J. Mark, University of Toronto, Canada.
Barnes, Charles Reid, Madison, Wis.
Baur, G., Clark University, Worcester, Mass.
Beal, W. J., Agricultural College, Mich.
Beals, A. H., Milledgeville, Ga.
Beauchamp, W. M., Baldwinsville, N.Y.
Boas, Franz, Clark University, Worcester, Mass.
Bostwick, Arthur E., Montclair, N J.
Bradley, Milton, Springfield, Mass.
Brinton, D. G., Philadelphia, Pa.
Chandler, H., Buffalo, N.Y.
Comstock, Theo. B., Tucson, Arizona.
Cragin, F. W., Colorado Springs. Col.
Davis, W. M., Harvard College, Cambridge, Mass.
Dimmock, George, Canobie Lake, N.H.
Farrington, E. H., Agricultural Station, Champaign, Ill.
Ferree, Barr, New York City.
Flexner, Simon, Johns Hopkins University, Baltimore, Md.
Foshay, P. Max, Rochester, N.Y.
Gallaudet, E. M., Kendall Green, Washington, D.C.
Garman, S., Museum of Comp. Zool., Cambridge, Mass.
Golden, Katherine E., Agricultural College, Lafayette, Ind.
Hale, Edwin M., Chicago, Ill.
Hale, George S., Boston, Mass.
Hale, Horatio, Clinton, Ontario, Canada.
Hall, T. Proctor, Clark University, Worcester, Mass.
Halsted, Byron D., Rutgers College, New Brunswick, N.J.
Haworth, Erasmus, Oskaloosa, Iowa.
Hay, O. P., Irvington, Ind.
Haynes, Henry W., Boston Mass.
Hazen, H. A., Weather Bureau, Washington, D.C.
Hewitt, J. N. B., Bureau of Ethnology, Washington, D.C.
Hicks, L. E., Lincoln, Neb.
Hill, E. J., Chicago, Ill.
Hill, Geo. A., Naval Observatory, Washington, D.C.
Hitchcock, Romyn, Washington, D.C.
Hotchkiss, Jed., Staunton, Va.
Howe, Jas. Lewis, Louisville, Ky.
Hubbard, Gardiner G., Washington, D.C.
James, Joseph F., Agricultural Dept., Washington, D.C.
Johnson, Roger B., Miami University, Oxford, O.
Kellerman, Mrs. W. A., Columbus, O.
Kellicott, D. S., State University, Columbus, O.
Macloskie, G., Princeton, N.J.
McCarthy, Gerald, Agricultural Station, Raleigh, N.C.
MacDonald, Arthur, Washington, D.C.
Marshall, D. T., Metuchen, N.J.
Mason, O. T., Smithsonian Institution, Washington, D.C.
Nichols, C. F., Boston, Mass.
Nuttall, George H. F., Johns Hopkins University, Baltimore, Md.
Oliver, J. E., Cornell University, Ithaca, N.Y.
Osborn, Henry F., Columbia College, New York City.
Osborn, Herbert, Agricultural College, Ames, Iowa.
Pammel, L. H., Agricultural Station, Ames, Iowa.
Pillsbury, J. H., Smith College, Northampton, Mass.
Ruffner, W. H., Lexington, Va.
Schufeldt, R. W., Washington, D.C.
Scripture, E. W., Clark University, Worcester, Mass.
Slade, D. D., Museum Comp. Zool., Cambridge, Mass.
Smith, John B., Rutgers College, New Brunswick, N.J.
Stevenson, S. Y., Philadelphia, Pa.
Stone, G. H., Colorado Springs, Col.
Thurston, R. H., Cornell University, Ithaca, N.Y.
Todd, J. E., Tabor, Iowa.
True, Frederick W., National Museum, Washington, D.C.
Turner, C. H., University of Cincinnati, Cincinnati, O.
Ward, R. DeC., Harvard University, Cambridge, Mass.
Ward, Stanley M., Scranton, Pa.
Warder, Robert B., Howard University, Washington, D.C.
Welch, Wm. H., Johns Hopkins University, Baltimore, M.D.
West, Gerald M., Clark University, Worcester, Mass.
Williams, Edward H., Lehigh University, Bethlehem, Pa.

SCIENCE

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SCIENCE

NEW YORK, JUNE 24, 1892.

AIMS OF LABORATORY TRAINING.[1]

BY CHARLES F. MABERY.

It is only within a comparatively recent period that the chemical laboratory has attained the prominent position it now occupies in colleges and schools of science. Indeed, in its present development, with facilities for practical study in inorganic and organic chemistry, both elementary and advanced, thirty years ago there was not a single laboratory in this country, and few elsewhere. Probably the earliest attempt in this country to give systematic laboratory instruction, to classes of any magnitude, was made in 1865 at the Massachusetts Institute of Technology. Analytical chemistry had previously been taught to a limited extent in a few institutions for the training of analytical chemists. In organic chemistry, or chemistry of the carbon compounds, instruction was first given by lectures and laboratory work in 1872 at Harvard College. On account, it may be, of the slight attention that technological and applied chemistry has received in this country as compared with Europe, few courses of study at the present date, even in the most prominent schools of science, include practical training in this subject.

In speaking of the functions of the modern chemical laboratory, it should be considered as an important factor in liberal education as well as a means of preparation for scientific pursuits; and we shall doubtless find our attention fully occupied in describing the principal aims of a laboratory devoted to pure and applied chemistry, without including the no less important work of laboratories in the special fields of agricultural, medical, biological, and sanitary chemistry. That a thorough training in general and descriptive chemistry should now form an essential feature in a liberal course of study, probably no one will venture to doubt. To the man of business, a knowledge of the composition and properties of materials is important as stock in trade. In the practice of law, decisions often involve a consideration of chemical changes as well as the composition of various substances. To men engaged in literary pursuits, in political life, or in the ministry, questions are frequently presented that require for their intelligent consideration a certain knowledge of chemistry. But especially to men engaged in any scientific pursuit, a good knowledge of substances, their occurrence, properties, and relations is indispensable. A chemical laboratory is therefore called upon to provide for each student broad and thorough training in the elementary principles of chemical science, including the composition and properties of matter. As to the best method for such instruction there may have been certain differences of opinion, but I think it is now universally conceded, that, while it is essential that the student should commit to memory important facts and principles as they are presented to him at the lecture table, it is in the laboratory that he recives the discipline of the hand and eye, and in methods of reasoning, that enables him to acquire the true spirit of scientific thought, and to retain a remembrance of facts that otherwise he would soon forget.

[1] An address delivered at the opening of the new chemical laboratory of the Case School of Applied Science, May 12, 1892.

As a foundation for more advanced study in science, especially in the various branches of chemistry, the analytical laboratory is an important adjunct. It is here that the student should not only receive most careful training in the methods of correct manipulation and close attention to the details of analytical processes, but he must acquire familiar acquaintance with the many analytical operations that he will be called upon to perform in the practice of his profession. It is unfortunately true that students are often content with the acquisition of sufficient knowledge to enable them to obtain positions as analytical chemists. Such training, however, is inadequate for the demands of the present day, since chemists are frequently called upon to undertake problems in technical chemistry that require broader qualifications. A very considerable part of manufacturing operations in industrial chemistry are based upon the properties and reactions of the carbon compounds, and any course of instruction in applied chemistry must be regarded as seriously deficient if it does not include thorough discipline in organic chemistry.

In a preparatory course of four years in chemistry, then, if thorough drill in the elementary chemistry of the first year is followed by instruction in analytic and theoretical chemistry, extending through two years, with an equally extended course on the carbon compounds, the student will be prepared in the fourth year to appreciate a comprehensive, practical course in industrial and applied chemistry. Incidentally, in the more advanced subjects, he should form at least some slight acquaintance with methods of study and investigation outside of the ordinary routine. Indeed, ability to undertake original problems such as are constantly presented for solution in industrial operations has a pecuniary value that is well recognized. It is in fact the basis of many commercial enterprises.

With this brief outline of what may be regarded as the principal aims to be kept in view in the management of a laboratory, perhaps it will be of interest to examine into the causes that have led to the recent development of laboratory methods. Although, as already explained, these methods have been largely developed within thirty years, it should not be understood that the foundation for them has been laid within this period. On the contrary, a knowledge of certain processes involving chemical principles conducive to the comfort and convenience of mankind is older than history itself. Metallic implements and coins of the bronze age indicate that the prehistoric races were acquainted with methods for the reduction and alloying of metals. That the ancient Egyptians understood the preparation of indigo and its application to dyeing is shown by the presence of tissues dyed with this substance on mummies taken from their oldest tombs. The extraction of turkey-red from madder was early known to the Egyptians, Persians, and Indians, and later to the Greeks and Romans. It would be impossible in a limited space to describe the numerous discoveries of the early ages, or the multitude of facts collected by the alchemists in their endeavors to discover the philosopher's stone which would enable them to transform the baser metals into the nobler, and in their search for the *elixir vitæ*, a panacea for all the ills of man. Notwithstanding this vast accumulation of facts, no efforts were made toward a systematic arrangement for the basis of a science, until late in the last century the foundation of chemistry as an exact science was established mainly through the labors of such men as Priestley, Scheele, Cavendish, and Lavoisier. To the latter especially is honor due for introducing the balance as a means of conducting chemical operations on a quantitative basis. The first great event of this period was the discovery of oxygen gas as a constituent of the atmosphere by Priestley, and it was soon followed by a determination of the composition of water, for which Cavendish receives credit. The classic experiment of Lavoisier, in which he ascertained the quantitative proportion of oxygen in the atmosphere, was the beginning of definite ideas concerning the composition of matter. The earlier part of the present century was honored by the brilliant researches of Sir H. Davy, Gay Lussac, Dalton, Berselius, and other investigators, which contributed so largely toward the foundations of modern chemistry, and which resulted in the law of gaseous combination of Gay Lussac, the laws of definite and multiple proportions of Dalton, and the law of Avogardro relating to the molecular composition of matter. These deductions were followed by many theories, which were later modified or replaced by others as new facts were discovered, until there has resulted a substantial system of nomenclature and theoretical principles, sufficient at least for working hypotheses, and sufficient to explain the greater portion of well-authenticated facts. Of recent contributions to chemical theories probably there are none of greater service in classification and arrangement, or that afford better opportunities for speculative research, than the periodic law which we owe to Newlands, Lothar Meyer, and Mendelejeff.

The application of chemical principles seldom precedes a good understanding of the principles themselves. Operations may indeed be carried on in a haphazard fashion according to empirical rules, but the results are apt to be unsatisfactory. We should therefore expect to see the development of technological chemistry following in certain lines the general advancement in scientific knowledge, and it is not difficult to understand the marvellous growth in applied chemistry during the last fifty years. Probably the most important branch of chemical industry that has ever been created is the manufacture of sulphuric acid. There is scarcely a commercial process involving chemical changes that is not dependent directly or indirectly upon the use of this acid; and, while at present the yearly production amounts to several million tons, it is only one hundred and fifty years since the lead-chamber process was first devised, and only one hundred years since Chaptal introduced the improvements for the continuous process now in use. A scarcely less important branch of industrial chemistry is that of bleaching, which resulted from the application by Berthollet, in 1788, of the properties of chlorine, already discovered by Scheele, in 1777, to destroy certain coloring principles without injury to the vegetable fibres. The manufacture of illuminating gas, which is such an important factor in modern life, was first attempted in 1798, and outside lighting with gas in 1812.

Many other illustrations might be presented to show how recent is the growth of technological chemistry, but it is in the domain of organic chemistry that the development has been most wonderful. Here is a quantity of urea, which, as everyone knows, is a constituent of various fluids in the circulation of animals. In 1828 the illustrious chemist Woehler obtained this substance simply by heating ammonium cyanate, and it was the first instance of the artificial preparation of a substance of organic origin. This was the beginning of synthetic organic chemistry. In attempting to illustrate what has since been accomplished in this field, we will select as a single example the multitude of substances that have been obtained from coal-tar, a bye-product in the distillation of coal for illuminating gas, and we will ask your attention to this chart, which shows a graphical arrangement of many of these compounds in their genealogical descent from coal.

With this brief review of the development of the chemical laboratory and the purposes of laboratory instruction, a question will doubtless arise as to its future efficiency in scientific education, and especially as to the part it will be expected to perform in promoting the material interests of society. While the utilitarian principle of the latter aim would naturally become the more important feature of laboratory training, in the school of science it should never be forgotten that whatever of mental culture or discipline the student receives must be derived from the courses of study that are intended as a preparation for his special vocation. Constant vigilance is therefore necessary to restrain the natural disposition of the average student, which leads him to avoid all possible mental exertion and to concentrate his energy upon the mechanical side of routine laboratory practice.

The elementary courses of the freshman year constitute the formative period, and if correct habits are early established, the more advanced work of later years will be undertaken in the true spirit of scientific study. But if, on the other hand, the student falls into careless or indifferent methods, it is rarely that he recovers from them. Concerning the preparation that must be provided to meet the demands of the future in applied chemistry, the foundation will be chemical analysis. No process involving chemical changes can be conducted intelligently and economically unless it is carefully controlled by a complete knowledge, not only of materials employed and valuable products obtained, but also of slags, gases, and all waste products. In the great smelting works in Europe ores are purchased for everything of value they contain. If a gold or silver ore contains, for example, arsenic, antimony, nickel, zinc, and bismuth, in appreciable quantities, the process of smelting will have due reference to the separation of every one of these constituents. In America, with enormous stores ot the richest ores and supplies ready at hand, miners and manufacturers have found the principal constituents too profitable to waste time in the recovery of bye-products. Many a western ore-dump will richly repay for reworking to recover what at first was thrown aside as unprofitable material, and in several directions this fact is even now receiving attention. If the price of coal in Cleveland was twelve dollars per ton, as it is in Switzerland, instead of two dollars per ton, the price now paid here, instead of an atmosphere laden with valuable fuel, the process of combustion would be controlled so that nothing but legitimate constituents of smoke could escape. Important changes in this respect, however, are in progress, and manufacturers are appreciating more fully the importance of accurate scientific knowledge and the services of skilled analysts.

Allusion has been made to a higher field for the employment of educated chemists than that of analytical chemistry, and it is one in which we may expect extensive developments. It is a familiar fact that many materials in daily use can only be obtained by importation from other countries; but the immense quantities of certain manufactured products annually imported may not be generally appreciated. Notwithstanding our abundant supplies of crude materials, with cheap fuel in unlimited quantities and a ready market with an increasing demand, we continue to pay enormous sums for imported products that should be produced at home. The causes of this condition of affairs should not be far to seek. That it is not from lack of enterprise is evident from the readiness with which novel schemes are able to secure financial support. It is generally understood that the principal hindrance to home production is the high cost of labor as compared with prices paid in Europe, and it is sometimes hinted that it is in part due to a lack of thoroughly trained scientific specialists. As regards the higher cost of manual labor here, it would seem that the difference must be less than the cost of importation, which includes the tariff. If this state of affairs is in any degree due to a dearth of scientific men capable of conducting manufacturing operations, and the scientific schools cannot produce such men, truly the schools are not taking advantage of their opportunities. That such a feeling exists with some manufacturers is evident from the fact that they send abroad for their chemists. Whether better talent is secured than can be obtained at home may well be regarded as an open question. Perhaps a still broader view of the situation is necessary; it may be that our invested capital is too busy in securing lucrative returns from business enterprises connected with the development of our natural resources to undertake operations that require skilful management to yield even a fair profit, and that we are therefore better content at present to pay importers' prices than to manufacture ourselves. If this be true, we must wait with patience for a change that will surely come.

Altogether the outlook for the immediate future is encouraging. In several directions the manufacture of chemical products has begun, and others will follow. There are certain lines along which rapid development may evidently soon be expected, and one of the most promising is sal-soda. Until quite recently the Le Blanc process, which was invented in France to manufacture soda-ash when the supply from natural sources was largely cut off during the French Revolution, has supplied the world since early in the present century. In utilizing all bye-products the great Le Blanc works of Europe have been able to produce soda-ash at a trifling cost. A Le Blanc plant has never been established here, and probably one never will be. Such a plant requires an immense capital, and, besides, a combination of coal, salt, and limestone, that can be found close at hand in but few localities. Within a few years another method, known as the ammonia-soda process, has been put into operation in Europe. The first-cost of a plant for this process is not large, and since it furnishes a purer product than the Le Blanc method, it will probably supply a considerable portion of the sal-soda of the future, especially in this country. The newer method has the especial advantage that it forms bicarbonate of soda direct and very pure. Two plants for this process have been erected here, one of which has been in operation at Syracuse, N.Y., for several years, and the other has recently been erected in Cleveland.

As another illustration of the possibilities in store for us, I will ask your attention to this lump of porcelain clay that came from a large deposit in Maryland, and there are large deposits in other localities. This clay is quite as pure and quite as well adapted for the manufacture of the finest porcelain as any in use in France or Germany. Of the other materials necessary in this industry, this quartz and this feldspar are just as pure, and we have extensive deposits of both. We have also cheap fuel, and yet we pay a tariff of forty-five per cent *ad valorem* for English, French, and German porcelain, besides paying the potter a fair price for his labor. All such porcelain as we have before us is made at the Royal Berlin Porcelain Factory, where it has been shaped, baked, and decorated by father and son for one hundred and thirty years. Who will venture to predict the possible developments in our own country during an equal period in the future? At present we make certain kinds of ware, but no one needs to be told the difference between it and the elegant Dresden, Sevres, or Royal Worcester.

A single additional example will doubtless suffice to show what we may reasonably expect in the future. The production of artificial dyes and colors from coal-tar has assumed enormous proportions since it was begun thirty years ago. Graebe and Liebermann invented the process for the preparation of artificial alizarine in 1869, and in 1880 it was estimated that this invention had saved $20,000,000, the additional cost if the same quantity of this dye-stuff had been obtained from natural madder. At present there are twelve large alizarine factories in Germany and England, but not one in the United States. The annual production of anthracene paste, the source of alizarine, is three thousand tons; but not a single pound is manufactured here. Of the total output of alizarine, 2,154,930 pounds, valued at $358,882, are consumed in this country. The estimated daily production of aniline and similar dyes, in England, France, and Germany, is estimated at 35,000 pounds, and in 1890 importations into the United States were valued at $1,787,558. Naphthalene, another constituent of coal-tar, until quite recently was practically a waste product; but thorough study of the naphtols, their sulphonic acids and other derivatives, has revealed the beauty and permanency of the numerous colors that may be derived from them, and they are now produced in considerable quantities. One factory in this country holds patents for the preparation of colors from naphtol-sulphonic acids. Yet with this condition of our manufactures we have the largest deposits of coal in the world, and the products of its distillation are collected in immense quantities. These products have even been sent abroad to be manufactered into colors and returned to us for consumption at a very high cost.

A clearer insight into the extent of our importations of products that might be produced at home may be given by a review of quantities and values selected from the Annual Report of the Bureau of Statistics on Foreign Commerce and Navigation for the year ending June 20, 1890: —

	Pounds.		Values.
Potassic chlorate	2,442,775		
" dichromate	1,166,000		
" ferrocyanide	849,070		
Total soda, including ash, salt-cake, bicarbonate	334,531,050		$5,099,327
		Duty	$1,688,071
Sodic hydrate	79,481,923		
Kaolin (tons)	27,136		
Total clays (tons)	336,488		
China and Pottery			$4,791,474
Glassware			$7,351,570
Glucose	911,573		
Iron, steel, and manufactures of the same			$43,493,074
		Duty	$18,384.175
Carbolic acid	522,237		
Oxalic acid	1,973,050		
Alizarine, artificial and natural	2,155,020		
Manganese binoxide	22,587,848		
Milk-sugar	339,684		
Alum	6,822,035		
Ammonium salts	6,911,323		
Coal-tar colors not enumerated			$1,813,771
Dextrine	9,183,566		
Glycerine (Crude)	11,811,308		
" (Refined)	210,545		
Lead acetate	19,000		

These illustrations are doubtless sufficient to indicate the extensive field that is open for the development of technological chemistry; and, with all deference to the aid that should be expected from the study of chemistry in the various systems of liberal education, they seem to afford convincing evidence that, in its highest efficiency, the chemical laboratory of the future should include the promotion of industries that depend upon the application of chemical principles.

NOTES AND NEWS.

THE railway which is at some time or other to traverse the African continent has been opened as far as a point near Cazengo, 140 miles from the starting-point, St. Paul de Loanda.

— A South African and International Exhibition will be opened at Kimberley in September. The processes of winning diamonds and gold will be shown; the machinery department will contain a large variety of machinery employed for mining and agricultural purposes; and the agricultural interests of the colonies and neighboring states will receive special attention.

— The British Medical Association, says *Nature*, will hold its sixtieth annual meeting at Nottingham on July 26, and the three following days. Mr. Joseph White, consulting surgeon of the Nottingham General Hospital, will preside. Addresses will be given in medicine by Professor James Cumming of Queen's College, Belfast; in surgery by Professor W. H. Hingston of Montreal; and in bacteriology by Dr. G. Sims Woodhead of the Research Laboratory of the Colleges of Physicians and Surgeons, England. The scientific work of the meeting will be done in ten sections.

— Through the courtesy of his friends, the editors of *The Scottish Geographical Magazine* have had an opportunity of perusing a diary by Mr. F. J. Matthew of a ride of 1,000 miles through a little-known part of the territory of the Argentine Republic. On Oct. 5 he started from Buenos Ayres by train, and reached Mendoza on the 7th. Thence he travelled, partly by coach, partly on horseback, to San Rafael, a distance of 210 miles. Having collected a store of provisions, the traveller set out on Nov. 16, with six mules and a man, and, crossing the river Diamante, took a westerly direction towards the Cordilleras, the route being through very beautiful scenery, for the Andes were not far distant, and the second night was passed at an elevation of 4,450 feet above sea-level. On the third day the river Atuel was reached, and two or three days later Mr. Matthew rested at the *estancia* of an English doctor living in Mendoza, where 15,000 sheep and 6,000 or 7,000 head of cattle are fed. Thirty miles from this *estancia* lies the lake Llancanelo, a narrow sheet of water several leagues in length. Two years ago part of it dried up, leaving a flat expanse of smooth sand nine miles across. Seen from the middle, this sandy plain has a bright-blue, glassy appearance, and counterfeits water wonderfully. The lake is fed by two streams, but has no visible outlet. It is said to be drained by a subterranean stream. At any rate, in the dried bed are to be seen several of those funnel-shaped depressions common in the Karst formation; their sides are encrusted with salt. The country around is wild, and the climate cool, the altitudes at which the camp was pitched being 5,600 to 5,800 feet. Game is plentiful. Herds of guanacos were often met with, and pumas are so numerous that horse-breeding is impossible, as they kill all the foals. Near Chacaico, where Mr. Matthew stayed a month, he observed eagles, condors — which are very destructive among the calves and sheep — rattlesnakes, otters, and a variety of chinchilla (probably the Alpine viscacha, *Lagidium Peruanum*). At Agua Nueva, twenty-one miles east of Chacaico, a large quantity of stock — horses, cattle, sheep, and goats — is fed by squatters, who pay a small rent for the use of the *camp* or run (*campo*). The pasture is excellent, but last year locusts played great havoc among the more tender grasses. The return journey was made across the Atuel and Salado rivers, and over the Central Pampa to Trenque Lauquen. The country, at first rocky, changed to level pampa of poor soil covered with prickly shrubs. Rain came down in torrents and swelled the rivers, so that they were difficult to cross. Water, which is scarce even among the mountains, is often not to be procured during a ride of fifty miles. Mosquitoes were troublesome, and at one camp a swarm of locusts obliged the traveller to pack up and move on. In the province of San Luis woods began to appear, and improved the landscape. Near Cochico is a series of shallow lakes of brackish water, studded all over with dry, barkless trees. For two or three days Mr. Matthew rode through dense woods, and then entered the grassy pampa, where *estancias* were more numerous, and the track well worn. Nothing but grass, reaching up to the knee of a man on horseback, can be seen the whole day long. Most of it is *pasto amargo* (bitter grass), and the sheep do not seem to thrive on it. The sheep are of different breeds — Lincoln, Merino, Rambouillet — and the cattle mostly crossed shorthorns. Trenque Lauquen is on a railway, by which Buenos Ayres can be reached in twelve hours.

— A new application of the stems of the larger-growing species of bamboo has recently been adopted in China for the manufacture of small trays and ornamental articles for export to Europe. It is known in China as bamboo sheeting, and it is said to be carried on at present only to a limited extent at Wenchow, where, notwithstanding that it is quite a new trade, about ten firms are now engaged in it. The process adopted is as follows: A length of bamboo is cut off, and then pared with an axe till it is of the thickness required. It is next planed with a spokeshave, and the thin cylinder so obtained is slit up, so that, on being opened out, it forms a sheet. A number of these cylinders, placed one inside the other, are immersed in boiling water for a few minutes, to render them flexible, and they are then unrolled and flattened out, by being subjected to pressure under heavy stones. These sheets are sometimes used for making fretwork and carved screens, fans, etc.; and the small, pale straw-colored pin-trays, for toilet tables, which appeared in the London shops last season, are apparently made from this specially prepared bamboo. It seems to adapt itself extremely well for moulding into many forms, and might be made available in this country for various kinds of veneering. The bamboo now appears to be the *Dendrocalamus latiflorus*, and specimens of the sheeting, and articles made from it, may be seen in Museum No. 2 of the Royal Gardens, Kew, says *The Journal of the Society of Arts*.

— The first sunshine recorder was the invention of Mr. John C. Campbell of Islay, and consisted of a hemispherical bowl, in which a spherical glass ball stood on a low pedastal. As the sun passed across the sky, its rays, concentrated by the ball, burned a groove in the side of the bowl. With this instrument the amount of sunshine during six months was roughly recorded, and the character of individual months was fairly shown, but the grooves of two successive days could not be distinguished from each other, the change in the sun's declination being very slight. Slips of cardboard were afterwards substituted for the wooden bowl; and in the present form of apparatus, devised by Sir G. G. Stokes, according to *The Scottish Geographical Magazine*, three brass grooves, concentric with the spherical lens and adjusted for the latitude, hold the cards for summer, winter, and the equinoxes, respectively. The cards are changed daily at sunset. This instrument is not without defects. When the sun is low it ceases to act, and at all times the slightest film of cloud, hardly visible to the eye, is sufficient to check the burning power of the sun's rays. Photographic processes have been devised by Mr. Jordan, Professor M'Leod, and others, but they are less easily managed. The Stokes-Campbell instruments have been in use since 1880, and the Meteorological Office has issued a report on the sunshine recorded during the years 1881–90. The sunniest spots in the Kingdom are the Channel Islands, which enjoy sunshine during 39.9 per cent of the time the sun is above the horizon in the course of the year. Falmouth shows the next highest record, 35.7 per cent, and along the whole coast of England from Milford Haven to Yarmouth there is no great variation. The coast naturally receives more sun than inland districts, where clouds are formed by the hills, and in towns the percentage is low owing to the smoke. As regards the monthly means, it is found that in Jersey alone does the sunshine ever attain to half the amount possible; 52 per cent is the value for May and 55 for August. Geldeston, in Norfolk, follows with 48 per cent, and the eastern coast as far north as Aberdeen is decidedly sunny. Ireland and the west of Scotland have persistently cloudy skies in summer and early autumn but in late autumn Ireland is particularly favored by the sun. On the other hand, from some unexplained cause, there is a deficiency of sunshine in Jersey during November. The sunniest month in the ten years was May, 1882, when thirty-three stations registered at least 50 per cent. June, July, and August, 1887, were also very bright. The highest monthly amount entered, 68 per cent, was recorded at Falmouth in June, and in Jersey in August of that year.

— Bulletin No. 30 of the Kansas Experiment Station reports a well-planned experiment, designed to show whether the old practice of shelling off the butts and tips of ears of seed-corn was a rational one. In this experiment five duplicate plants were planted with seed from different parts of the ear. This question has also been under investigation for several years at the Ohio Experiment Station. There is a remarkably close agreement between the average yields from butts and middles in Kansas and Ohio, but this agreement does not hold out when it comes to the tips. The experiment is being continued at the Ohio station, as they are still in doubt whether the irregularities in yield observed are due to the seed or to the inevitable variations in the soil of different plats, a factor of error which can only be overcome by many repetitions of the test. In view of the results thus far indicated it may be well to call attention to the possibility of the middle of the ear failing to dry out in some seasons as well as the ends, in which case it would be less valuable instead of more valuable for seed.

— The next meeting of the International Congress of Orientalists will be held at Lisbon, from Sept. 23 to Oct. 1 of the present year, under the patronage and chairmanship of the King of Portugal. All societies and individuals will be considered members of the congress upon the payment of 25 francs. All applications should be sent to the Secretary of the Geographical Society, Hotel de la Société, Lisbon, Portugal. The scientific programme will embrace the following sections: Summary of Oriental Researches since 1891; Semitic Languages, except Arabic; Arabia and Islam; Assyriology; Palestinology; The Aryan Languages, including, 1, Sanscrit and Hindustanee, 2, Pahli (language of Ceylon) and Buddhist, 3, Iranian and Zoroastrian; Africa, with the exception of Egypt; Egyptology; Central Asia and Dardistan; Religions Compared (Mythology, Mythography, Philosophy, Laws, Oriental Sciences, History, etc); Languages Compared; Encouragement of Oriental Studies; Indo-Chinese Studies; Chinese Studies; Japanese Studies; Dravidian Studies; Malay Archipelago and Polynesia; Questions for Explorers; Ethnographic Philology and Migration of Races; Art, Archæology, Numismatics, and the Industrial Art of the East; The Scholars and the People of the East; Oriental Philology in Commerce, etc. (with subdivisions for the different modern Oriental languages); Anthropology, The Science and the Natural and Artificial Products of the East; The Orient and America; The Orient and Portugal; Special Section for the Phillipine Islands; Exhibition of Books and Objects to Illustrate the above Sections.

— In the course of a journey through British New Guinea, in January last, says the Proceedings of the Royal Geographical Society, the indefatigable Administrator, Sir William Macgregor, examined and described several remarkable islands, which he shows to be almost certainly ancient atolls that have been elevated by steady horizontal uplift. The island generally known as Kitava (but called Nowau by the natives) has an area of about five or six square miles. It appears to be surrounded by a fringing reef. Nearly all round the island there is a low and slightly sloping margin covered with trees, and about a quarter of a mile wide. This terminates inland in a steep coral wall, which rises abruptly to the height of 300 or 400 feet, and is covered with forest. Shells in the coral point to a comparatively recent upheaval. From the crest of this wall the land dips gently to a plateau from 50 to 100 feet lower, which occupies the centre of the island. The plateau is undulating, has a rich chocolate soil, and being protected from wind by the raised rim, whilst subject to a copious rainfall, it is very fertile. All the people live in the hollow, so that from the sea the island seems to be uninhabited. The central hollow is drained by filtration through the cracked and porous coral rock. Kwaiawata Island, which is from one and a half to two miles in diameter, showed precisely the same form and structure, and in Gawa Island there is a still more perfect instance of a raised atoll. The coral wall in the last instance rises so abruptly to the height of about 400 feet that part of it has to be climbed by ladders, and the plateau representing the old lagoon is nearly 100 feet below the level of the edge. Iwa, another adjacent island about a mile in diameter, is of the same kind, only the gently sloping border has been worn away, and the coral cliff meets the sea nearly all round. These remarkable islands merit more detailed study by a geologist on account of their obvious bearing on the theory of coral formations, and their resemblance to the upraised reefs of the Solomon Islands. It would appear that the area of post-tertiary elevation which Dr. Guppy demonstrated in the Solomon Islands must be extended to include the border islands of New Guinea as well.

— Brick tea has usually but little to commend it, as it is known to be composed of the sweepings and dust of the Chinese tea factories. Its chief market is Russia, which took from China last year 2,005,548 pounds, one-half the usual export, due, it is said, to the scarcity of tea dust. A new article in tea has, however, according to the *Journal of the Society of Arts*, recently sprung up in China, in the form of tablet tea, which appeared in the trade returns of Kiukiang for the first time last year, machinery having been erected there for its manufacture, and the quantity shipped from that port was 493,398 pounds. Tablet tea is made from the very best quality of tea dust. It is formed, by pressure alone, into small cakes, which are perfectly hard and solid, and somewhat resemble chocolate in appearance. The material is not, like brick tea, moistened with steam, before being compressed, and the flavor is not in any way impaired by the process of manufacture.

— An experimental voyage, which, though its main object is commercial, is not without interest of a more general kind, is about to be undertaken by Captain Gray of Peterhead, the well-known Arctic whaler. Captain Gray is of opinion that the value of the Antarctic Seas as a whaling-ground has never been properly tested, and he has, according to the Proceedings of the Royal Geographical Society, succeeded in raising the capital necessary for prosecuting an experimental voyage with a couple of vessels of some 400 or 500 tons register, propelled by auxiliary engines of 70 or 80 horse-power nominal. A statement issued by Captain Gray and his brother contains numerous extracts from the literature on the Antarctic regions, as evidence that there is a reasonable prospect of developing a new and important industry in the Southern Seas. "We have," say the authors of the statement, "been induced to select that region in the Antarctic area lying between the meridian of Greenwich and 90° west longitude as the locality in which, in our opinion, the fishery we have projected might be prosecuted with the greatest advantage. It was explored by Captain Ross in his last voyage, and has been reported by him to be frequented by the right whale in great numbers. It is besides accessible from Britain by a direct route lying between the continents of America and Africa, not exceeding 7,200 miles in length, or a two months' passage, at an average speed of five knots per hour. We think that the month of December, corresponding to that of June in the northern hemisphere, which has generally been chosen for the commencement of the work of exploration in the Antarctic Seas, is too late, and that it might be prosecuted with advantage at least a month earlier. We should therefore recommend that, on the event of vessels being fitted out to prosecute the fishery in the South Polar Seas, they should leave the country in August, and reach the whaling-ground by the end of October, which would give at least four months, viz., November, December, January, and February — ample time for completing their cargoes, and enable them to reach Britain again in May, thus leaving from three to four months for discharging and refitting before sailing on a new voyage in August." As Baron Nordenskjöld's son is to accompany the expedition as naturalist, it is to be hoped that some gain to geography may result.

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WEEDS AS FERTILIZING MATERIAL.

BY CHARLES FREDERICK MILLSPAUGH.

WE have initiated a number of experiments at this station with a view of determining the actual average value of composted weeds as manurial substances upon the basis of the commercial value of their mineral constituents. For this purpose about fifty weeds have so far been gathered in the same manner and at the same time that the farmer should so gather them for compost. Our chemist, Dr. de Roode, finds that each has a certain value according to its species, yielding nitrogen, phosphoric acid, and potash, as seen in the following table, from which we have computed the money values according to the commercial value of the minerals at this place.

Name.	Nitrogen.	Phos. ac.	Potash.	Value.
Poke-weed, *Phytolacca decandra, L.*	3.34	.65	8.00	$21.93
Bitter Dock, *Rumex obtusifolius, L.*	2.94	.50	4.29	16.26
Common Thistle, *Cnicus lanceolatus (L.), Willd.*	2.44	.62	5.53	15.79
Crow-foot Grass, *Panicum sanguinale, L.*	1.89	.90	4.67	13.39
Sheep Sorrel, *Oxalis corniculata v. stricta. (L.), Sav.*	2.04	.61	3.02	12.74
Fox-tail Grass, *Setaria glauca (L.), Beauv.*	1.77	.75	4.52	12.41
Pleurisy-weed, *Asclepias tuberosa, L.*	2.02	.86	3.31	12.35
Sweet Clover, Bokhara Clover, *Melilotus alba, L.*	2.40	.50	1.95	11.87
Burdock, *Arctium lappa, L.*	1.85	.96	3.07	11.69
Ox-eye Daisy, *Chrysanthemum leucanthemum, L.*	2.12	.46	2.88	11.66
Horse-weed, Wild Lettuce, *Lactuca canadensis, L.*	1.07	.47	2.20	11.53
Wild Carrot, *Daucus carota, L.*	1.65	.62	4.21	11.47
Butter-weed, *Lactuca leucophœa (Willd.), Gray.*	2.06	.52	2.89	11.44
Deer-tongue Grass, *Panicum clandestinum, L.*	1 95	.76	2.90	11.44
Blue Thistle, *Echium vulgare, L.*	1.45	.80	4.56	11.35
Iron-weed, *Vernonia noveboracensis (L.), Willd.*	2.07	.42	2.11	10.63
Clot-bur, *Xanthium strumarium, L.*	1.51	.73	3 45	10.43
Climbing Buckwheat, *Polygonum dumetorum, scandens (L.), Gray.*	1.93	.40	2.31	10.38
Yarrow, *Achillea millefolium, L.*	1.71	.50	2.98	10.28
Wild Flax, Toad Flax, *Linaria vulgaris, Mill.*	1.83	.64	2.30	10.27
Lobelia, Indian Tobacco, *Lobelia inflata, L.*	1.79	.65	2.35	10.11
Stickweed, White Devil, *Aster lateriflorus (L.), Britt.*	1.92	.56	1.61	9.80
Briars, *Rubus villosus, Ait.*	1.51	.32	.74	9.68
Wing-Stem, *Actinomeris alternifolia (L.), D.C.*	1.40	.94	2.73	9.55
Old White-top, Velvet-grass, *Holcus lanatus, L.*	1.30	.45	3 72	9.38
Boneset, *Eupatorium perfoliatum, L.*	1.70	.53	1.94	9.23
Timothy, *Phleum pratense, L.*	1.48	.63	2.65	9.21
Milk-Weed, Wild Cotton, *Asclepias Syriaca, L.*	1.71	.93	.78	8.77
Blue Devil, *Aster cordifolius, v. laeviagatus, Porter*	1.49	.52	2 25	8.74
Wild Coreopsis, *Coreopsis triptris, L.*	1.56	.48	1.54	8.22
Nail-rod, Stick-Weed, *Aster lateriflorus, var. hirsuticaulis, Gr.*	1.47	.49	1.83	8.20
Wire-grass, *Eatonia Pennsylvanica (Spr.) Gray*	1.32	.52	2.26	8.10
Red-top, *Agrostis alba, var. vulgaris (With.) Thurb.*	1.39	.40	2.10	8.02
Quill-weed, Queen-of-Meadow, *Eupatorium purpureum, L.*	1.41	.36	1.81	7.83
Canada Thistle, *Cnicus arvensis (L.), Hoffm.*	2.06	.45	2.74	7.58
Sorrel, *Rumex acetosella, L.*	1.38	.21	1.89	7.47

Indian Hemp, Rheumatism-weed,				
Apocynum androsaemifolium, L.	1.60	.44	.69	7.47
Elders.				
Sambucus canadensis, L.	1.56	.31	1.00	7.41
Rag-weed,				
Ambrosia artemisiaefolia, L.	1.36	.41	1.79	7.32
Goldenrod,				
Solidago juncea, Ait.	1.27	.39	1.62	7.15
Spanish Needles,				
Bidens frondosa, L.	1.24	.32	1.92	7.14
Orchard Grass,				
Dactylis glomerata, L.	.95	.54	2.61	7.08
Naked-weed, Skeleton-weed,				
Chondrilla juncea, L.	1.13	.74	1.27	6.74
Oat-grass,				
Danthonia spicata (L.) Beauv.	1.13	.28	1.77	6.50
Old-field Balsam,				
Gnaphalium obtusifolium, L.	1.04	.41	1.75	6.35
Evening Primrose, Wild Beet,				
Oenothera fruticosa, L.	1.05	.39	1.68	6.29
Blue-joint,				
Andropogon provincialis, Lam.	.73	.24	1.29	4.44
Broom Sedge,				
Andropogon scoparius, Michx.	.78	.21	.68	3.68
Panicled Panic-grass,				
Panicum virgatum, L.	.60	.28	.68	3.40
Average	1.60	.53	2.51	$9.60

It will be seen, that, if this is a fair number of species to draw conclusions from, weeds properly composted should be worth $9.60 per ton These values are of course computed upon a water-free basis, while the farmer would gather with his weeds about 50 per cent of their weight in water. We have, however, proved that proper composting, especially with the addition of lime, rots and kills all the seeds of the weeds gathered; and argue that, if the farmer thus removes the weeds from his lands and roadsides, thereby decreasing the annual production and continued presence of the same, that if he thus relieves his fields of the trash, giving more room for good, clean grass, that if he places upon his cultivable ground the humus that it would otherwise never receive, that if he is thus taught to utilize all such matter as has heretofore gone to waste upon his farm and in his ditches and roads, this compost would be raised by these profitable issues to the full value of the dry material as given above.

W. Va. Agr. Exp. Station.

NOTES ON LOCAL MEMBRACIDÆ AND FULGORIDÆ.

BY E. B. SOUTHWICK, PH.D.

IN the MEMBRACIDÆ, the sub-family DARNINÆ is represented by *Ophiderma salamandra* Fairne., which with us is very rare. *Ophiderma mera* Say and *O. arcuata* Say are both recorded from New Jersey, and Fitch records *mera* as occurring in New York and feeding on the butternut.

In the sub-family SMILIINÆ we have several species, *Acutalis tartaria* Say being quite common and very variable in coloration, some of them being nearly black. *Acutalis calva* Say is much smaller and exceedingly rare.

Telamona ampelopsidis Harr. is represented by half a dozen specimens. It is quite rare. A friend informs me that a few years ago he found it very common on Ampelopsis in this city. I have one specimen of what is labeled *Tragopa calva* Say. It is shaped very much like *T. ampelopsidis* Harr., save that the apex of the hump is more narrow I have not taken any other species of *Telamona*, although several are recorded from New Jersey and New York.

Thelia is represented by *bimaculata* Fabr. It is rare, and but two specimens were taken, both from elder (*Sambucus*).

Ceresa is represented by three species: *brevicornis* Fitch, *bubulus* Fabr., and *diceros* Say, the latter being very rare, and the other two species common.

Stictocephala festina Say is very common and very uniform in size. *S. festina* Say I have never taken, although it should occur with us.

In the sub-family HOPLOPHORINÆ I have never taken a representative species. But *Plotycoris quadrivittata* Say and *P. vittata* Fabr. are both recorded from New Jersey, and should occur here also.

In the sub-family MEMBRACINÆ, *Enchenopa binotata* Say is very common indeed. I have taken it from the butternut, Viburnum; New Jersey tea (*Ceanothus*), bittersweet (*Celastris*), and white birch. *Ptelea*, grape, *Cercis*, and locust are also given as its food-plants. On *Ceanothus* it is very abundant in all stages of transformation, and a species of black ant is very attentive to it in the pupa state, no doubt obtaining from it honey-dew, as in the case of Aphides. When disturbed they become formidable enemies and bite one's hand very severely.

Enchenopa curvata Fabr., now known as *Campylenchia curvata* Fabr., is exceedingly common; and the length of the projection of the thorax, for a long time, led me to believe there were two species. But Professor Van Duzee says they are one and the same species; that is, those with the long, curved thorax and those with the short and less curved thorax.

In the family FULGORIDÆ and sub-family CIXIINÆ I have one species of *Phypia* not known to Professor Van Duzee. *Cixius stigmatus* Say is very rare, or at least is so very delicate as to be easily torn and unnoticeable, which may account for its scarcity in my collection.

Otiocerus Degeerii Kirby is represented by a single pair. This is a very curious, as well as beautiful insect, with its long fore-wings widening out like a fan at the ends.

In the sub-family DITYOPHORINÆ we have *Scolops sulcipes* Say and *S. angustatus* Uhl., the former a common species and the latter quite rare. *Monopsis tabida* Spin. I have never taken, but it probably occurs here.

In the sub-families ISSINÆ and CALOSCELINÆ I have never taken a single representative species. But, in the sub-family FLATINÆ, *Ormenis pruinosa* Say and *O. septentrionalis* Spin. are very common. *Pruinosa* has formerly been known as *Flata pruinosa* and *Poeciloptera pruinosa* Say. This insect is common on the white birch; but I have taken it from the elm and maple, more particularly from the young sprouts. Dr. Riley records it as feeding on red clover, *Erigeron canadensis*, and quite a number of other plants and shrubs, not specified; and Dr. Fitch records it as occurring on the gooseberry and rhubarb. It is quite a general feeder, but with us it seems to affect the white birch most. Dr. Fitch also mentions its occurrence on the privet in New York, but I have never discovered it on this shrub, although it is everywhere abundant in Central Park.

Amphiscepa bivitata Say is very common with us; but I have not as yet, from my own observation, found out what plant it feeds upon most, as the sweep-net gathers it from grasses and weeds alike.

THE TEXAS ACADEMY OF SCIENCE.[1]

BY DR. EVERHART.

FOR some time past there has been a feeling on the part of some of those here present that the time was ripe for the formation of a Scientific Association in this State. This feeling needed but a word to find expression of approval and to inaugurate the movement. This word was spoken a little over a month ago, and immediate steps were taken to bring about the present result. The professors of science, natural and exact, in this university, held an informal meeting in the early part of January and decided to send to various men engaged or interested in scientific work in Texas invitations to meet here on the ninth of January for the purpose of organizing a Scientific Society. These invitations met with a most cordial response from everyone. The meeting was held at the time named and organization perfected.

The plan and scope of the Texas Academy of Science are intended to be somewhat similar to those of the National Academy of Sciences at Washington.

As will be seen in the constitution already adopted, the object of the academy is threefold. In the first place it is intended that an opportunity should be given to the scientists of the State to have personal intercourse with each other, to exchange ideas, and to discuss scientific questions of the day. Were this the only object of the academy, still its organization would be well worth the effort, for by this personal intercourse between men of different or kindred pursuits, and by this interchange of thought, and by the consequent regarding various questions from many different standpoints, men become less rusty in those branches of science other than their own, they become more tolerant of the opinions of others, and are compelled to leave those ruts fostered by isolation and freedom from contradiction. To the teacher especially is this feature of the academy valuable. He, necessarily, has always to speak ex cathedra. In presenting subjects to his classes he is lawyer, judge, and jury. To such a man discussions with his equals are a necessity. It is urged upon the members of this academy, therefore, that they not only contribute to its success by scientific papers, but that they will also further its aims and their own advantage by attendance on the meetings.

The second object of this association is to investigate and report on any subject pertaining to the natural or exact sciences, when called upon by any of the departments of the State government. It is intended that this should always occupy a prominent place among the objects of the academy. Apart from our obligations as citizens of Texas, many, perhaps even the majority of us, are particularly indebted to the State. The furthering of her interests, therefore, is of paramount importance, and the development of her resources will promote not only her welfare, but also the welfare of science. We trust that in the near future this Academy of Science will be legally recognized by the State, and that a union profitable to both will be consummated.

The chief idea, however, in forming this association is the promotion of science, natural and exact. To this end it is contemplated that at all regular meetings of the academy original papers or well-digested reports on scientific topics will be presented and discussed. With the present membership, and with the present status of science in Texas, it can hardly be expected that original memoirs will always be on hand, still if the members of the academy will interest themselves in its aims, there is no reason to doubt that we will have during the course of each year at least a respectable number of valuable contributions to science. Our incentives to this desirable result are our duty to the academy, to Texas, and to science.

The chief aims of this organization are, I repeat, the cultivation and promotion of science. By science I mean true science, the search after truth in nature. Science in its practical applications will have no difficulty in finding followers; the question of how much money a scientific law or fact will produce is the prime object of the many, but there is a much more exalted side of science, and it is to this side that I invite your attention for a few moments.

I do not mean to depreciate the motives or the usefulness of those who devote their time and energy to the practical utilization of science in our everyday life, but I do mean that there is something higher and nobler than that in science, and that the one who cultivates this side of science has the nobler aim in life. The true scientist is not restricted by the narrow limits of practical utility; his domain is wider and his investigations freer. The discovery of a new law in science can not be measured by money; its influence is exerted on all mankind and lasts forever. In the past century many scientific laws have been discovered, any one of which has done more towards the amelioration of the lot of man than all the alms and charities since the beginning of time.

The practical scientific man is always the follower of his master in theoretical or pure science, and is entirely dependent on the latter for his inventions. There have been given but few inventions to the world that were not based on previous discoveries made by men who neither expected nor cared to make money out of their chosen science. The practical scientist adapts laws to commercial purposes, but he never discovers laws.

One sometimes reads of indexes of civilization and prosperity proposed for various nations. For example, an English writer has said that the civilization of a land might be measured by the amount of sulphuric acid it manufactures. Another has proposed iron, still another soap, as an index, but it strikes me that the civilization and progress of a country may be much more accurately gauged by the amount of attention it pays to pure science. There is no doubt but that Germany stands at the head of all nations in practical science of all kinds, and equally certain is it that no country is so thoroughly impregnated with a pure scientific spirit or is so prolific of men who devote their lives to science in its highest aspects. These are the men who really give to the world those ideas the practical utilization of which has given us our present advancement. These men may be but little known except to students. How many of us, for instance, know even by name Kolbe, Lothar Meyer, Hofmann, Kekule, Wislicenus, or Ostwald? Yet these chemists, by their discoveries, have opened and are now opening vast avenues to trade and commerce and otherwise contributing to the welfare of their fellow-men. These are the real benefactors of mankind, and their example should be emulated by all scientists who have the love of science in their hearts. There is no nobler life than that of a man who devotes himself to science. It is unselfish, it is a search after truth, and it benefits mankind. No higher attributes can be assigned to any other calling.

Very often one is asked what this or that experiment is good for. It is sometimes difficult to make the questioner

[1] Introductory Address, by Dr. Everhart, President of the Academy, Feb. 6, 1892.

comprehend that although there may be no apparent money value in the investigation, still it has a scientific value. The scientist in an investigation rarely thinks of its practical application, yet some of the greatest godsends to the human race have resulted from these theoretical researches. For example, medicine would have no knowledge of chloroform, ether, acetanilide, antipyrin, potassium bromide, and countless other equally valuable preparations, were it not that these substances were discovered during theoretical investigations. Again, when Faraday was working on the bad-smelling, dirty-looking coal-tar, who ordinarily would have supposed that his isolating from this unpromising substance benzine and some of its derivatives would revolutionize many industries and inaugurate others that now have a capitalization of millions and millions of dollars? Faraday's researches rendered possible the coal-tar color industry.

Numberless instances of the practical value of theoretical investigations might be given, but the above will suffice.

There is, perhaps, a popular prejudice against the scientific man. This prejudice was formerly directed against mathematicians only, but is now being extended to other scientists. There is no outcry against them, but their advice and conclusions are often thought inferior to those of the so-called practical man. Unfortunately for the pockets of these people confiding in the judgment of the practical or rule-of-thumb man, their ventures nearly always come to grief. I believe that the amount of money lost in this way, even during the last twenty years, amounts to more than the national debt. This popular idea is due entirely to ignorance and to unfamiliarity with science and scientific men and methods. It is hoped that this Academy of Science will be able, both directly and indirectly, to help educate the people to put their confidence in those that are worthy of it. When this is brought about we will no longer have companies organized to make a Keely motor, nor to refine sugar by electricity, nor will we have men digging for gold in every rock, or looking for bituminous coal in alluvial formations.

I believe that with these aims before us we can make the academy a success and a benefit to science. Texas has ample and first-class material in her young men for the making of future scientists, both pure and practical. We should encourage by every means in our power the study and prosecution of the exact and natural sciences, because, no matter what may be said to the contrary, on them rest our comfort, our welfare, our progress, physically, mentally, morally.

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.*

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

On request in advance, one hundred copies of the number containing his communication will be furnished free to any correspondent.

Causes which Produce Cold, and Mild Periods.

IN *Science* for Aug. 21 and Feb. 19, I pointed out what I conceived to be the cause of the frigid and warm periods. Still, in order to make my views more plain, further explanation, and repeating, may be necessary.

The tropical surface-waters of the ocean when moved into the high latitudes in large volumes, thus adding their warmth to the heat imparted by the sun, are undoubtedly able to cause a mild climate. This is the opinion of most writers on climatic changes. Still, it seems to me, while viewing the subject from a marine standpoint, that they have only partly comprehended the manner in which the ocean waters are moved in a latitudinal direction. Consequently, their explanations have never proved satisfactory to those who have considered the subject. The only way in which tropical waters are moved into the high latitudes, in quantities sufficient to cause a mild climate, is through the force of the great prevailing winds of the globe. These winds, as is well known, blow mostly from the east towards the west in the tropics, and from the west towards the east in the high latitudes. This counter-movement of the winds, in connection with land of great latitudinal extent, like the western continent, is able to move the tropical waters far into the northern and southern seas. But in order to do such work perfectly, the land should extend unbroken from the Arctic to the Antarctic circles; because, under such conditions, the westerly winds would blow the surface-waters of the ocean away from the eastern shores in the high latitudes, and so cause extensive low sea-levels, while the easterly winds of the torrid zone would heap the ocean waters against the tropical shores of the continent. Consequently, the warm waters of the tropical high sea-level would be moved by gravitation to the low sea-levels of the high latitudes, even to the Arctic and Antarctic regions, and thus afford them a mild climate. In this way we account for the mild climates enjoyed by the temperate and polar regions during early ages. For it is probable that during such times the wide channel of comparatively shoal water, which now separates the western continent from the Antarctic shores, was a region of low land, and the channels leading into Baffins Bay and Davis Strait were also closed. But since the Tertiary period the low land that connected Cape Horn with the southern continent has been flowed by the sea; which may have been caused through a tendency of the ocean waters southward, or a comparatively small movement in the earth's crust. This flowed region as now represented increases in depth from its northern and southern shores to 1,000 fathoms in its middle portion. The channel has probably been greatly deepened since its first flowage, through the scouring of ice-sheets for thousands of years of successive ice-periods; and it is owing to its waters separating the Antarctic shores from South America that prevents the strong westerly winds of that region from creating a low sea-level in the high southern latitudes. Therefore, the waters of the torrid zone heaped against the South American coast by the trade-winds are not at this date attracted far into the southern seas. It is true they flow along the coast of Brazil to an inferior low sea-level, caused by the westerly winds blowing the surface-waters away from the coasts of Argentine and Patagonia, but on gaining that region they are met by the cold currents which pass through the channels opening into the Pacific, and so turned away from the more southern latitudes. The westerly winds further south, owing to the Cape Horn channel being open, cause, as I have before explained, a drift current to extend around the southern portion of the globe, which largely turns away all tropical currents setting southward. And it is through this exclusion of tropical waters from the high southern latitudes, ice-sheets have been able to gather and will continue to gather on the southern continent and extend into its shallow seas, until the channel separating the western continent from the Antarctic lands is closed. The closing of this channel with ice is only a question of time should the snowfall of that region continue to be as great as it is now.

The Antarctic ice-sheet may have been over ten thousand years in gaining its present extent and thickness, and it may require as much, or more, time to perfect it. Yet it is probable that the larger portion of its coast-line cannot be extended seaward, on account of the great depth of the ocean bordering its shores. But where the water is comparatively shoal the ice-sheet must advance until all the neighboring shallow seas and channels are filled, and a broad isthmus of ice connects the Antarctic lands with the western continent. This being perfected, the strong westerly winds of the southern latitudes will blow the surface-waters away from the Atlantic side of the isthmus, and so cause an extensive low sea-level sufficient to attract the tropical waters from the high sea levels abreast Brazil and the east coast of Africa well into the southern ocean, and thus cause in time a mild climate in the Antarctic regions, as I have before pointed out.

In the northern latitudes we see the Arctic channels severing the western continent from the more northern lands; and it is through these passages the Arctic currents flow and largely occupy the low sea-level, caused by the westerly winds along the American coast from Greenland to Florida. We also see the tropical waters heaped against Mexico, attracted to the same low sea-level, thus causing the Gulf Stream. But the waters of this stream, while on their northern passage, are so obstructed by the opposing Arctic currents, they fail to reach the higher northern latitudes; consequently heavy glaciers have gathered and still are gathering on Greenland and other Arctic shores, and this increase of cold will continue in unison with the growing cold of the Antarctic regions until the Arctic channels are closed with ice, and a northern ice-age completed. But when the Arctic channels are closed, the Gulf Stream will be able to reach a much higher latitude than now, as it would meet with no obstruction except the return current of its own waters, which would probably flow down the east coast of Greenland, where the Arctic waters now flow. Thus, with less obstruction, the movement of tropical waters into the Arctic regions, which, in connection with increasing warmth in the southern hemisphere, would be able to bring about a warm period in the northern latitudes of considerable duration, on account of the glaciers filling the Arctic straits being situated to the windward of the tropical currents, and, in consequence of their cold location, would be the last ice to melt in the northern regions.

It has been the opinion of several writers that should the whole of the warm Gulf Stream water flow into the Arctic Ocean it would probably remove the ice of Greenland, and it is reasonable to suppose that such would be the case. But, as far as I know, such theorists always fail to explain how tropical waters are ever made to flow into the high latitudes. They have nothing to say of the low sea-level trough, caused by the westerly winds, extending from Georgia to Greenland, and thus attracting both the Arctic and Gulf-stream waters in opposite directions over fifteen hundred miles along the American Coast. For were it not for this low sea-level the Gulf Stream would not be able to move so far northward as it now flows, but would spread out. were the Atlantic a level plain, and become a drift current much further southward; especially with the Arctic currents opposing it from the north.

Professor Geikie asserts that there can be no doubt whatever that periods succeeding the Tertiary have been characterized by great oscillations of climate — extremely cold and very genial conditions alternating; and that during the frigid period, where we now have the greatest rainfall, the greatest snowfall took place. He also says, that during such times changes in the relative level of the land and sea had taken place. But he did not believe that there had been any great movement in the earth's crust. For while giving his views on the earth-movement hypothesis he declared that there was not the least evidence of great continental elevations in the northern hemisphere, and even if such improbable earth-movements were admitted they would not account for the glacial period. The assertions of Professor Geikie, that where we now have the greatest rainfall, in glacial times the greatest snowfall took place, shows that the prevailing winds during the cold period must have blown in the same direction they now blow. Consequently, the great ocean currents, being governed by the prevailing winds, were during the glacial period moving in the same direction they now move. But the great Southern Ocean drift current lost its independent movement when the Cape Horn channel was closed with ice; which, according to the common course of nature must again be brought about. Thus, in the future, as in past glacial periods, the strong westerly winds that sweep the Southern Ocean would blow the surface waters away from the leeward side of the ice isthmus and so cause a low ocean-level; and it appears that the only water that could be attracted to this low sea-level would be the tropical water heaped against Brazil by the trade-winds. This tropical water on gaining the low ocean-level would spread over its wide depression, where the westerly winds would cause it to become a drift current, and in this way it would be moved along the shores of the Antarctic continent past the South Indian and South Pacific oceans and eventually be forced against the Pacific side of the ice isthmus and Patagonian coast, and so cause a high ocean-level. This high level would vastly increase the volume of the Humboldt current, which would flow, as it now flows, down the South American coast to the equatorial latitudes, where it would become the main source of the great equatorial current. The latter current with an increased volume would also move as it moves to-day, across the Pacific, and through the East India passages into the Indian Ocean, where it would flow on partly as a drift current until it joined the great Mozambique current, which would flow southward along the east coast of Africa, the same as it now flows. At this age, when this continuation of the great equatorial stream gains the latitude of the Cape of Good Hope, its waters are largely turned eastward by the great drift current of the Southern Ocean; but a considerable portion of its waters turn towards the west forming the Agulhas current, which flows around the Cape of Good Hope into the Atlantic, where it mingles with the cooler currents, which branch off from the great southern drift current; and so in connection with the latter waters is moved by the south-east trade-winds towards the equatorial Atlantic and coast of Brazil. Thus it will be seen that the Agulhas current, while giving additional warmth to the Atlantic, serves to retard somewhat the advance of the coming cold period.

The Agulhas current also partly serves to replenish the water which at this date is forced from the South Atlantic by the strong westerly winds into the southern Indian and Pacific oceans. For it appears that more water is now removed by such winds from the South Atlantic than enters it from the Cape Horn channel. This channel being less than half of the breadth of the westerly wind-belt of the Southern Ocean, the drift currents do not all pass through it from the Pacific into the Atlantic. Consequently, a considerable portion of the drifting water turns northward west of Cape Horn, and so forms the Humboldt current. Therefore, the Agulhas stream, which even now assists in replenishing the Atlantic, would be a much stronger current with the Cape Horn channel closed; because the South Atlantic waters would continue as now to be forced eastward by the strong westerly winds, yet they could not be replenished as they are to-day directly from the Pacific; therefore, the waters of the whole Atlantic Ocean would be correspondingly reduced. Such conditions alone would greatly swell the warm Agulhas stream at the culmination of a frigid period, and thus greatly assist the Atlantic in its operations while bringing about a warm period. Dr. Croll, in his astronomical theory, declares the ice periods of the northern and southern hemispheres to be consecutive. But when we consider the wide connection and circulation of the tropical seas it seems impossible for a glacial epoch to be perfected in one of the hemispheres with a mild climate extending over the opposite portion of the globe. And it appears to me that the tropical lands I have visited show indications of having at times experienced a temperature sufficiently cold for snow and ice to have gathered on their highlands, and in some locations glaciers may have extended to the sea. Besides it is well known that Alpine plants exist on the high mountains of the tropics; and it also appears that during some ancient period the climate has been favorable for their crossing the lower lands of the torrid zone, which tends to show that the frigid periods of the two hemispheres were concurrent.

C. A. M. TABER.

Wakefield, Mass., June 13.

European Origin of the White Race.

I HAVE received so many letters questioning my statement in *Science*, March 25, that Omalius d'Halloy, and not Dr. Latham. was the first to maintain the European origin of the white race, that it seems due to the former scientist, as well as to myself, to quote his words. Even such a thorough-paced archæologist as M. Salomon Reinach, of the National Museum, St. Germain-en-Laye, writes: "Where did you hear that Omalius had presented the European theory before Latham? I am sure that it is not so."

Now if these inquirers will turn to the Bulletins de l'Academie Royale de Belgique, Tome XV., No. 5, May, 1848, they will find an article of 16 pages, entitled "Observations sur la Distribution ancienne des Peuples de la Race blanche," par M. J. J. Omalius d'Halloy, beginning with this sentence: "Dans une série de notes que j'ai présentées à l'Académie de 1839 à 1844, j'ai cherché à faire voir, entre autres considerations ethnographiques, que la race blanche, restreinte dans ce que je considère ses véritables limites, présente trois modifications principales, *et qu'il n'est nullement démontré que les ancêtres des Européens actuels soient venus d'Asie.*" (Italics mine.)

The author then proceeds to discuss the evidence, physiological, historical and linguistic, which had been thought to show that the Indo-European peoples originated in Asia; and combats it at every point, marshalling his arguments to prove that the true white type is distinctly European; and that the ancient Sanscrit and Zend are in no wise maternal languages of the Indo-European stock, but merely sisters of the Greek, Latin, and ancient German.

The earliest expression of this view by Dr. Latham, so far as I know, is that referred to by Professor Haynes, in this journal, April 8, which was published in 1851,—years, therefore, after Omalius had urged the same theory in a number of papers. It is strange, indeed, and regrettable, that an endless chain of writers have given credit where it did not belong for this bold and certainly in great measure correct theory. D. G. BRINTON.

Media, Pa., June 20.

AMONG THE PUBLISHERS.

PROFESSOR HUXLEY is collecting his papers on the "Gadarene Swine" and other controversial topics, which he contributed recently to the *Nineteenth Century*, and will issue them with a new preface.

— Fleming H. Revell Company has just ready "Peeps into China," by the Rev. Gilbert Reid, M.A., of the American Presbyterian Board, a series of observations on the manners and customs of the Chinese.

— G. P. Putnam's Sons have ready "Materialism and Modern Physiology of the Nervous System," by Dr. William H. Thomson, Professor of Materia Medica in the University of New York; and "Who Pays Your Taxes?" a compilation by Bolton Hall of the opinions on taxation of David A. Wells, George H. Andrews, Thomas G. Shearman, Julien T. Davies, Joseph Dana Miller, the compiler and others, which is one of the "Questions of the Day Series."

— Ginn & Co. have in preparation "A Students' Edition of the Age of Fable," on the basis of Bulfinch's "Age of Fable" (1855), adapted to school use and to the needs of beginners in English literature and in the classics, in part rewritten, accompanied by interpretative and illustrative notes, by Charles Mills Gayley, Professor of the English Language and Literature in the University of California, and formerly Assistant Professor of Latin in the University of Michigan.

— Longmans, Green & Co. will publish immediately a new edition of Professor Max Müller's lectures on "India: What can it Teach Us?" which were delivered at Cambridge to the candidates for the Indian Civil Service. They will bring out at the same time a new edition of the first volume of Professor Max Müller's "Gifford Lectures," on "Natural Religion," delivered at Glasgow in 1889. Professor Max Müller is preparing for the press the fourth volume of his "Gifford Lectures," on "Psychological Religion," but it is not likely to appear before the end of the year.

— Messrs. D. Appleton & Co. announce for early publication "Controverted Questions," a new book by Professor Huxley; "The Principles of Ethics," Vol. I., by Herbert Spencer; "The Canadian Guide-Book, Part II., Western Canada," a handsomely illustrated volume by Ernest Ingersoll, describing Western Canada from Ottawa to Vancouver, and uniform with "The Canadian Guide-Book, Part I., Eastern Canada," by Professor C. G. D. Roberts, of which a new and revised edition is now ready; "The Naturalist in La Plata," illustrated by W. H. Hudson, joint author of "Argentine Ornithology." New editions, fully revised, of Appletons' well-known "General Guide to the United States and Canada," and "Appletons' Summer Resorts," are to be published immediately.

— Mr. C. Michie Smith has edited a work embodying "Results of the Meteorological Observations made at the Government Observatory, Madras, during the years 1861–90, under the direction of the late Mr. Norman Robert Pogson." The volume, according to *Nature*, is published by order of the Government of Madras. It was Mr. Pogson's intention to issue the work as soon as he could after the completion of thirty years of observation, and at the time of his death a considerable part of the manuscript was nearly ready for press. In editing the work, Mr. Smith, so far as possible, has retained the original plan. He expresses much admiration for the skill and thoroughness with which the observations were organized and carried out.

— In the *Political Science Quarterly* for June Professor John Bassett Moore continues his study of "Asylum in Consulates and in Vessels," bringing it down to the late affair in Chili; John Hawks Noble presents a concise summary of "The Immigration Question" as it stands at present; Robt. Brown, Jr., gives the salient points in the history of "Tithes in England and Wales;" Professor Ugo Rabbeno, of Bologna, Italy, expounds and criticises "The Landed System of Social Economy," as contained in the works of his fellow-countryman, Achille Loria; Ernest W. Clement discusses "Local Self-Government in Japan;" and Professor A. B. Hart, of Harvard, writing on "The Exercise of the Suffrage," argues against the project of compulsory voting and gives statistical tables bearing on the subject. The book reviews include over twenty publications, and Professor Dunning brings his Record of Political Events down to May 1.

— C. W. Bardeen of Syracuse, N. Y., has published a little pamphlet by Professor N. M. Butler on "The Place of Comenius in the History of Education." It does not sketch the incidents of Comenius's life, and gives only a partial account of his educational theories, the defective parts of his work being for the most part kept out of sight. Comenius held certain notions about the matter and manner of teaching of which Professor Butler himself is a strong partisan, and he is glorified in this pamphlet accordingly. Indeed, our author would have us believe that nearly all those views and practices that go by the indefinite name of "the new education" were anticipated by the Moravian educator who was born three centuries ago. Yet when we come down to facts, we find that his anticipations were often very vague, while many of the ideas he held, and on which Mr. Butler lays much stress, are at the present day little better than fads. The point most insisted upon by Mr. Butler is that Comenius was the first to maintain that education is, or should be, a drawing out and developing of the faculties. But surely that idea is expressed in the etymology of the word *education*, a fact which proves that the idea is very old. Comenius holds an honorable place in educational history, but he was no such paragon as Mr. Butler would have us believe.

— The Clarendon Press, says *Nature*, will publish immediately a second volume of Professor Weismann's work on "Heredity and Kindred Biological Problems." It contains four essays, of which only the shortest has previously appeared in an English form (in the columns of *Nature*). The first essay deals with degeneration, and clearly shows by abundant illustrations that it has resulted from *panmixia*, or the cessation of natural selection. The second is an attempt to explain the development of the art of music, and to show that the hereditary transmission of the results of practice is quite unnecessary in order to account for its rise. The third contains a reply to certain objections urged by Professor Vines. It will be useful in giving clearer expression to the ideas on the death of multicellular beings and the immortality of the unicellular. The fourth and last essay is by far the longest and most important. It deals with the essential significance of sexual reproduction and conjugation, etc., as inferred from the results of the most recent researches. Professor Weismann's older views on these subjects, especially concerning the polar bodies, have been modified and in part abandoned. The immortality of unicellular beings and the question of the transmission of acquired characters by them are also discussed in detail with reference to recent observations.

— We learn from *Nature* that Mr. R. H. Scott has contributed an article entitled "Notes on the Climate of the British Isles," to *Longman's Magazine*. The author gives some amusing instances of the distortion of facts at seaside stations, where the observers are anxious to prove the advantages of their own towns over those of their rivals. Taking the whole year round, the warmest spot is the Scilly Isles, which are a degree warmer than either the west of Cornwall or the Channel Islands; while the coldest region on the coast is the extreme north-east of Aberdeenshire. In winter very little difference of temperature is met with all along the east coast; but the coldest part of England lies round the Wash. With regard to the variability of temperature, or the difference of the mean temperature of an entire day, the equability of the temperature of these islands is very great. The only locality for which a more uniform temperature has yet been published is Georgetown, Demerara; the figure for this place is 1.1°, while for London is 2.7°. All the great changes of temperature occur in winter, and accompany sudden thaws. As regards bright sunshine, the Channel Islands are by far the most favored. On the mean of the whole year Jersey secures 39 per cent; but from the Bristol Channel to the coast of Norfolk there is but little difference in the amounts recorded. In cities like London the deficiency is due to smoke. The statistics relating to fog are not yet completely discussed, but so far as they go they show that in winter the foggiest district is the east coast of England. Next come London and Oxford, which are about equal. With regard to rainfall the east coast stations receive on an average of the whole year about half as much as those on the west coast, the amount being about 25 inches on the east coast, 30 to 40 inches between Sussex and Devonshire, and fifty inches to the south of Cornwall. In the west of Ireland the amount rises to 70 or 80 inches, owing to high land near the coast. The driest hour almost everywhere is noon.

— No document can give a better account of an Indian's acts or mode of thinking than a document composed by himself and put down correctly in his own words and language. In describing Indian feats of war, council debates, or stories, the author of the white race feels perfectly dwarfed when he compares his account to the phraseology of the Indian, who, with a few powerful strokes of the tongue, tells us much more accurately and forcibly what he intends to convey to our minds about his people. The numerous myths, stories, and historic recitals published in James A. Dorsey's new volume ("The Dhegiha Language," 18 and 794 pp., Washington, 1890, quarto) will fully bear out this statement. The author has made accessible to us the Omaha and Ponka language, not only by publishing the Indian texts as dictated to him by the natives and adding to them a readable English translation, but he has also subjoined an interlinear translation for each Indian

Publications Received at Editor's Office.

Dolbear, A. E. Matter, Ether and Motion. Boston, Lee & Shepard. 12°. 342 p. $1.75.
Fletcher, L. The Optical Indicatrix. London, Henry Frowde. New York, Macmillan & Co. 8°. 124 p.
Hatch, F. H. Mineralogy. London, Whittaker & Co. 12°. 132 p. $1.
Missouri Botanical Garden. Annual Report, 1892. The Trustees. 8°. 170 p.
Troy, Daniel S. The Value of Money. Montgomery, Ala., Brown Printing Co. 8°. Paper. 26 p.
Year-book of the Scientific and Learned Societies of Great Britain and Ireland. London, Charles Griffin & Co. 8°. 239 p.

Exchanges.

[Free of charge to all, if of satisfactory character. Address N. D. C. Hodges, 874 Broadway, New York.]

Taxidermist going out of business has quantity of finely-mounted specimens of North American birds, mammals and reptiles and skins of birds for sale, including a full local collection of bird skins, showing some great variations of species; also quantity of skulls with horns of deer and mountain sheep, and mounted heads of same. Will give good exchange for Hawk Eye camera with outfit. Apply quickly to J. R. Thurston, 265 Yonge St., Toronto, Canada.

For exchange.—A fine thirteen-keyed flute in leather covered case, for a photograph camera suitable for making lantern slides. Flute cost $27, and is nearly new. U. O. COX, Mankato, Minn.

To exchange; Experiment Station bulletins and reports for bulletins and reports not in my file. I will send list of what I have for exchange. P. H. ROLFS, Lake City, Florida.

Finished specimens of all colors of Vermont marble for fine fossils or crystals. Will be given only for valuable specimens because of the cost of polishing. GEO. W. PERRY, State Geologist, Rutland, Vt.

For exchange.—Three copies of "American State Papers Bearing on Sunday Legislation," 1891, $2.50, new and unused, for "The Sabbath," by Harmon Kingsbury, 1840; "The Sabbath," by A. A. Phelps, 1842; "History of the Institution of the Sabbath Day, Its Uses and Abuses," by W. L. Fisher, 1859; "Humorous Phases of the Law," by Irving Browne; or other works amounting to value of books exchanged, on the question of governmental legislation in reference to religion, personal liberty, etc. If preferred, I will sell "American State Papers," and buy other books on the subject. WILLIAM ADDISON BLAKELY, Chicago, Ill.

For Sale or Exchange for books a complete private chemical laboratory outfit. Includes large Becker balance (200g. to 1-10mg.), platinum dishes and crucibles, agate motors, glass-blowing apparatus, etc. For sale in part or whole. Also complete file of *Silliman's Journal*, 1862-1885 (62-71 bound); Smithsonian Reports, 1854-1883; U. S. Coast Survey, 1854-1869. Full particulars to enquirers. F. GARDINER, JR., Pomfret, Conn.

Wanted, in exchange for the following works, any standard works on Surgery and on Diseases of Children: Wilson's "American Ornithology," 3 vols.; Coues' "Birds of the Northwest" and "Birds of the Colorado Valley," 2 vols.; Minot's "Land and Game Birds of New England;" Samuels' "Our Northern and Eastern Birds;" all the Reports on the Birds of the Pacific R. R. Survey, bound in 2 vols., morocco; and a complete set of the Reports of the Arkansas Geological Survey. Please give editions and dates in corresponding. R. ELLSWORTH CALL, High School, Des Moines, Iowa.

To exchange Wright's "Ice Age in North America" and Le Conte's "Elements of Geology" (Copyright 1882) for "Darwinism," by A. R. Wallace, "Origin of Species," by Darwin, "Descent of Man," by Darwin, "Man's Place in Nature," Huxley, "Mental Evolution in Animals," by Romanes, "Pre-Adamites," by Winchell. No books wanted except latest editions, and books in good condition. C. S. Brown, Jr., Vanderbilt University, Nashville, Tenn.

Wants.

Any person seeking a position for which he is qualified by his scientific attainments, or any person seeking some one to fill a position of this character, be it that of a teacher of science, chemist, draughtsman, or what not, may have the 'Want' inserted under this head free of cost, *if he satisfies the publisher of the suitable character of his application. Any person seeking information on any scientific question, the address of any scientific man, or who can in any way use this column for a purpose consonant with the nature of the paper, is cordially invited to do so.*

WANTED.—We want any and all of the following, providing we can trade other books and magazines or buy them cheap for cash: Academy, London, vol. 1 to 28, 35, Jan. and Feb., '89; Age of Steel, vol. 1 to 66; American Antiquarian, vol. 1, 2; American Architect, vol. 1 to 6, 9; American Art Review, vol. 3; American Field, vol. 1 to 21; American Geologist, vol. 1 to 6; American Machinist, vol. 1 to 4; Art Amateur, vol. 1 to 7, Oct., '4; Art Interchange, vol. 1 to 9; Art Union, vol. 1 to 4, Jan., '44, July, '45; Bibliotheca Sacra, vol. 1 to 46; Godey's Lady's Book, vol. 1 to 20; New Englander, vol. 11; Zoologist, Series 1 and 1, Series 3 vol. 1 to 14; Allen Armendale (a novel). Raymer's "Old Book" Store, 243 4th Ave. S., Minneapolis, Minn.

WANTED.—By a young man, a Swarthmore College junior, a position as principal of a public high school in one of the Gulf States, or as instructor in botany, physiology, and geology in an academy or normal school. Address B., care of Librarian, Swarthmore College, Penn.

WANTED.—A teacher of Geology who is familiar with the fossils of the Hamilton Group, as instructor of Geology during July next at the Natural Science Camp on Canandaigua lake. Apply to ALBERT L. AREY, Director, 229 Averill Ave., Rochester, N. Y.

WANTED.—To act as correspondent for one or two daily or weekly papers. Have worked on paper for about two years. Would like a position on editorial staff of humorous paper. Address GEO. C. MASON, 14 Elm St., Hartford, Conn.

TRANSLATOR wanted to read German architectural works at sight (no writing). One familiar with technical terms desired. Address "A.," Box 149, New York Post Office.

WANTED.—A position in a manufacturing establishment by a manufacturing Chemist of inventive ability. Address M. W. B., care of *Science*, 874 Broadway, N. Y.

WANTED.—Books on Anatomy and Hypnotism. Will pay cash or give similar books in exchange. Also want medical battery and photo outfit. DR. ANDERSON, 182 State street, Chicago, Ill.

WANTED.—A college graduate with some normal training, to teach the sciences, at $1,800 per year, in a Southern college. A Baptist or a Methodist preferred. Must also be a first-class Latin scholar. A. H. Beals, Box K, Milledgeville, Ga.

ADDRESS WANTED.—Will some one please send the address of the Secretary of the American Philological Society. Also that of Herbert Spencer. "ADDISON," Room 84, 164 Madison St., Chicago, Ill.

word, as it occurs in the sentence. This enables us to study that dialect with comparative ease, and opens to us the innermost soul-life, the very fabric of Indian thought, by the disclosure of the grammatic elements. To these Indians, the categories of number and tense are not very material, and that of sex is never marked as such; but it is quite important to them whether the object spoken of or the acting subject is visible or invisible, close by, further off, or at a great distance. It matters little to these Indians of what special appearance the subject or object is, but they have to express with accuracy, whether it was standing or sitting, reclining or stretched out, acting on purpose or without purpose, and whether those acting were acting singly, in a small body, or in a crowd. Whether a story-teller is relating a fact from his own knowledge or from hearsay, has to be distinctly stated in every one of his sentences, and from the term here used it also becomes apparent whether he has heard the statement from one person or from several authorities. Although Dorsey's contributors have related to him many tribal events which we would call traditional history, we feel in reading them that they are based on historical facts and truly Indian sociological conditions, and, as such, are just as valuable to us as many facts recorded by official historiographers of the white race. What we need for their understanding is a profound and not a desultory study of these and other Indian pieces of oral literature. Students to whom the volume has not been sent should apply for it to the member of their congressional constituency.

—The following are from the table of contents of the July number of *The Chautauquan:* Overland by the Southern Pacific, by Fannie C. W. Barbour; Hay Fever as an Idiosyncrasy, by J. M. Cooper, M.D.; In the Snake River Valley, Part II., by John R. Spears; Historic Quebec, by Edith Sessions Tupper; Summer Vacations and Physical Culture, by J. M. Buckley; The Beginnings and Endings of Centuries, by Count Charles de Mouy; Some American Chemists, by Marcus Benjamin; The Great Exposition at Chicago, by Noble Canby; Why American Children are Nervous, by Mrs L. E Chittenden; Marriage in Nanking, by Harriet Linn Beebe.

QUERY.

Can any reader of *Science* cite a case of lightning stroke in which the dissipation of a small conductor (one-sixteenth of an inch in diameter, say,) has failed to protect between two horizontal planes passing through its upper and lower ends respectively? Plenty of cases have been found which show that when the conductor is dissipated the building is not injured to the extent explained (for many of these see volumes of Philosophical Transactions at the time when lightning was attracting the attention of the Royal Society), but not an exception is yet known, although this query has been published far and wide among electricians.

First inserted June 19. No response to date.

N. D. C. HODGES,
874 BROADWAY, NEW YORK.

TO THE READERS OF SCIENCE.

PUBLISHER'S ANNOUNCEMENT.

OUR PLANS.

Within the past six months the use of *Science* by scientific men and women as a medium for prompt publication and weekly discussion, has increased very materially, so that the pages are now well filled each week with original matter. As the number of those promising contributions is increasing at the rate of three or four each day, it cannot be long before *Science* at its present size will be too small for the amount of matter offered. We have under consideration therefore an enlargement of the paper by one-half, but must first learn the temper of our constituency as to an advance in price to $5.00, which was the subscription price from the start for four years, up to June 30, 1887. Further, to carry out the proposed enlargement, we shall need five hundred additional subscribers. If you are not already a subscriber, are you willing to aid in making *Science* more worthy of American scientific work by becoming one?

It goes without saying, that the demand for scientific literature is limited, when compared with that for literature which is more to the public taste, so that the receipts of most of the Scientific Journals, in this country, do not pay quite for their printing and paper, to say nothing of the other items of expense. We say this merely to emphasize the fact, that generous and prompt support must be accorded this move if it is to succeed.

Titles of Some Articles Published in *Science* since Jan. 1, 1892.

Aboriginal North American Tea.
Actinism.
Amenhotep, King, the tomb of.
Anthropology, Current Notes on.
Arsenical Poisoning from Domestic Fabrics.
Anatomy, The Teaching of, to Advanced Medical Students.
Astronomical Notes.
Botanical Laboratory, A.
Brain, A Few Characteristics of the Avian.
Celts, The Question of the.
Collection of Objects Used in Worship.
Deaf, Higher Education of the.
Diphtheria, Tox-Albumin.
Etymology of two Iroquoian Compound Stems.
Eye-Habits.
Family Traits, Persistency of.
Fishes, The Distribution of.
Fossils, Notice of New Gigantic.
Grasses, Homoptera Injurious to.
"Healing, Divine."
Hemipterous Mouth, Structure of the.
Hypnotism among the Lower Animals.
Hypnotism, Traumatic.
Indian occupation of New York.
Influenza, Latest Details Concerning the Germs of.
Infant's Movements.
Inventors and Manufacturers, the American Association of.
Iowa Academy of Sciences.
Jargon, The Chinook.
Klamath Nation, Linguistics.
Lightning, The New Method of Protecting Buildings from.
Lissajou's Curves, Simple Apparatus for the Production of.
Maize Plant, Observations on the Growth and Chemical Composition of.
Mineral Discoveries, Some Recent, in the State of Washington.
Museums, The Support of.
Patent Office Building, The.
Pocket Gopher, Attempted Extermination of.
Psychological Laboratory in the University of Toronto.
Psychological Training, The Need of.
Rain-Making.
Rivers, Evolution of the Loup, in Nebraska.
Scientific Alliance, The.
Star, The New, in Auriga.
Storage of Storm-Waters on the Great Plains.
Teaching of Science.
Tiger, A New Sabre-Toothed, from Kansas.
Timber Trees of West Virginia.
Tracheæ of Insects, Structure of.
Vein-Formation, Valuable Experiments in.
Will, a Recent Analysis of.
Wind-Storms and Trees.
Wines, The Sophisticated French.
Zoology in the Public Schools of Washington, D. C.

Some of the Contributors to *Science* Since Jan. 1, 1892.

Aaron, Eugene M., Philadelphia, Pa.
Allen, Harrison, Philadelphia, Pa.
Baldwin, J. Mark, University of Toronto, Canada.
Barnes, Charles Reid, Madison, Wis.
Baur, G., Clark University, Worcester, Mass.
Beal, W. J., Agricultural College, Mich.
Beals, A. H., Milledgeville, Ga.
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Gallaudet, E. M., Kendall Green, Washington, D.C.
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Golden, Katherine E., Agricultural College, Lafayette, Ind.
Hale, Edwin M., Chicago, Ill.
Hale, George S., Boston, Mass.
Hale, Horatio, Clinton, Ontario, Canada.
Hall, T. Proctor, Clark University, Worcester, Mass.
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Hay, O. P., Irvington, Ind.
Haynes, Henry W., Boston Mass.
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Hewitt, J. N. B., Bureau of Ethnology, Washington, D.C.
Hicks, L. E., Lincoln, Neb.
Hill, E. J., Chicago, Ill.
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Howe, Jas. Lewis, Louisville, Ky.
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McCarthy, Gerald, Agricultural Station, Raleigh, N.C.
MacDonald, Arthur, Washington, D.C.
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Nuttall, George H. F., Johns Hopkins University, Baltimore, Md.
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Osborn, Henry F., Columbia College, New York City.
Osborn, Herbert, Agricultural College, Ames, Iowa.
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Pillsbury, J. H., Smith College, Northampton, Mass.
Ruffner, W. H., Lexington, Va.
Schufeldt, R. W., Washington, D.C.
Scripture, E. W., Clark University, Worcester, Mass.
Slade, D. D., Museum Comp. Zool., Cambridge, Mass.
Smith, John B., Rutgers College, New Brunswick, N.J.
Stevenson, S. Y., Philadelphia, Pa.
Stone, G. H., Colorado Springs, Col.
Thurston, R. H., Cornell University, Ithaca, N.Y.
Todd, J. E., Tabor, Iowa.
True, Frederick W., National Museum, Washington, D.C.
Turner, C. H., University of Cincinnati, Cincinnati, O.
Ward, R. DeC., Harvard University, Cambridge, Mass.
Ward, Stanley M., Scranton, Pa.
Warder, Robert B., Howard University, Washington, D.C.
Welch, Wm. H., Johns Hopkins University, Baltimore, M.D.
West, Gerald M., Clark University, Worcester, Mass.
Williams, Edward H., Lehigh University, Bethlehem, Pa.